

**Prevalence of cardiovascular disease risk factors
among Iranians in Edinburgh compared to
Edinburgh White and Iranian general populations:
findings of two systematic reviews and a pilot study**

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PhD

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Dedicated to:

My parents

I declare that this thesis:

a. Has been composed by myself

b. It is my own work

c. Has not been submitted for any other degree or professional qualification except as specified

Abstract

Introduction: Ethnic differences exist in the UK regarding the cardiovascular diseases (CVD). But despite a growing population of Iranian migrants there are relatively few health related studies on them and none in the UK.

Aims: To develop methods, gain experience and to acquire estimates to inform full scale future cardiovascular health survey, Iranian subjects in Edinburgh were compared in a pilot study with Edinburgh's White and Tehran's population.

Methods: Two preliminary systematic reviews were conducted to make decisions about useful recruitment methods of Iranian migrants and also on the pilot study variables. Based on the MOOSE guidelines (Meta Analysis of Observational Studies in Epidemiology) nine databases were searched and identified articles were assessed for their quality. A multi-method recruitment strategy was applied to recruit 72 Iranian migrants in Edinburgh. For comparison purposes based on one to many (variable) matching design five controls for each of the recruited people were selected randomly from the databases of an exemplar study in Scotland (Scottish Health Survey 2003) and also in Iran (Tehran Lipid and Glucose Study 2001). Prevalence rate ratio and mean difference were calculated with 95% confidence interval. Analysis of variance and conditional logistic regression were applied for data analysis where appropriate.

Results: In the first systematic review from 31 relevant articles 17 unique studies met the inclusion criteria with considerable heterogeneity in the methodologies used. A wide range of participation rates was observed. Participation rate in studies that used snowball sampling ranged from 19.0% with postal questionnaires and 99.0% with telephone interview. Participation rates were in the range of 33.3-57.0% in studies with convenience sampling method and 21.3-68.1% in studies with random sampling methods. Given the small number of studies on this ethnic minority and the diversity of methodologies it was not possible to analyse them statistically. The limited data available suggest that application of a multi-method recruitment approach and translation of the study questionnaire may increase participation rate.

In the second systematic review from 104 relevant articles 28 unique studies met the inclusion criteria, of which 25 were reports of original cross sectional prevalence studies

in Iran and three were studies on Iranians living abroad. Meta-analysis was performed to calculate overall summary data from eligible studies. According to the results 32.9% (95%CI: 26.6-39.9%) of Iranian men and 32.5 % (95%CI: 26.3-39.5%) of women were overweight. Obesity was seen among 22.6% (95%CI: 14.2-34.1%) of the women and 7.7% (95%CI: 4.5-12.9%) of the men. Self-reported smoking rate was prevalent among 1.3% (95%CI: 0.6-2.4%) of women and 17.7% (95%CI: 10.2-28.8%) of Iranian men. The lowest reported smoking rate for Iranian women abroad was 10.5% (95%CI: 7.2-15.1%).

Findings of the pilot study indicated that only 8.2% (95%CI: 3.2-19.2%) of Iranian men and 21.7% (95%CI: 9.7-41.9%) of women in Edinburgh had moderate or vigorous physical activity level. Overweight or obesity was prevalent among 79.6% (95%CI: 66.4-88.5%) of the Iranian men and 60.8% (95%CI: 40.8-77.8%) of the women. Self reported smoking rate was 30.6% (95%CI: 16.8-49.0%) among the Iranian men and 13.0% (95%CI: 3.4-39.3%) among the women. Having an abnormally low level of high density lipoprotein (HDL-C) was considerably more prevalent among Iranians in Edinburgh than the Edinburgh White population and prevalence rate ratio in the male subgroup was 3.5 (95%CI: 1.4-8.9) and in the female subgroup was 9.9 (95%CI: 2.3-43.2).

Discussion: The systematic reviews indicated considerable gaps in the evidence base and so importance of a future large scale study on Iranian Diaspora. Findings of the pilot study indicate the extent of the prevalence of CVD risk factors in the Iranian Diaspora and important methodological issues that must be considered in any future health related studies. Bearing in mind probability of selection bias, the results indicated added risks among the recruited Iranian migrants in Edinburgh with regard to some of the CVD risk factors such as smoking and low physical activity level compared to Edinburgh's White population. Due to differences between the studies, such comparisons must be interpreted with extreme caution. To have a precise picture about the CVD status of Iranian migrants, data from a representative sample of UK Iranians is needed.

Conclusion: This is the first study of its kind ever undertaken in the UK and its findings can help efforts to control CVD in Iranians living in the UK and similar European

countries. This pilot study shed light on one of the important but least talked aspect of health needs in a relatively sizeable subgroup of ethnic minorities in the UK and other European countries. The findings revealed that conducting of a future large scale study on Iranian migrant population is feasible.

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Glossary of terms *

Body mass index (BMI): individual's body weight in kilogram divided by the square of his/her height in metre.

Cardiovascular disease (CVD): also known as heart and circulatory disease refers to the class of diseases that affect the heart and circulatory system.

Coronary heart disease (CHD): a gradual build up of fatty deposits on the walls of coronary arteries which leads to narrowing of arteries and thus difficulty in supplying heart muscle with blood and oxygen.

Edinburgh White population: those people from White Scottish, White Irish, White British or any other White backgrounds who were resident of Edinburgh when Scottish Health Survey 2003 was conducted.

Ethnicity: The social group a person belongs to, and either identifies with or is identified with by others, as a result of a mix of cultural and other factors including language, diet, religion, ancestry, and physical features traditionally associated with race.

Healthy life expectancy: The number of years a person can expect to live in good health and free from disease at a given age.

HDL-C: high density lipoprotein or good cholesterol is one of the major groups of lipoproteins which enable lipids like cholesterol and triglycerides to be transported within the blood stream.

Indigenous: This term is usually used to mean a person who belongs naturally to a place in the sense of long term family origins.

Iranian: those who were born from a native Iranian mother and/or father and considered themselves as being an Iranian.

Ischaemic heart disease (IHD): characterised by reduced blood supply to the heart muscle usually due to coronary artery disease.

* Ethnicity related terms explained by Professor Raj S. Bhopal in his article titled "Glossary of terms relating to ethnicity and race: for reflection and debate" (1) were applied where appropriate.

LDL-C: low density lipoprotein or bad cholesterol is one of the major groups of lipoproteins that transport cholesterol and triglycerides from the liver to peripheral tissues.

Life expectancy: The average expected lifespan of a person at a given age.

Oral glucose tolerance test (OGTT): is performed to identify diabetic patients or those with impaired fasting glycaemia 2 hours after a 75 gram oral glucose load in subjects who should fast before test for at least 14 hours.

Race: The group a person belongs to as a result of a mix of physical features such as skin colour and hair texture, which reflect ancestry and geographical origins, as identified by others or, increasingly, as self identified.

Very low density lipoproteins (VLDL): is one of the major groups of lipoproteins made by the liver that enable fats and cholesterol to move within the blood stream.

White-coat effect: refers to a physiological reaction in patients caused by anxiety and is commonly seen in the hospitals or outpatient departments.

Abbreviations and acronyms:

AD: Anno Domini
ABP: Ambulatory Blood Pressure
AHA: American Heart Association
AIDS: Acquired Immuno-Deficiency Syndrome
ADA: American Diabetes Association
BC: Before Christ
BHS: British Hypertension Society
BMI: Body Mass Index
CAC: Coronary Artery Calcium
CCS: Conventional Cluster Sampling
CHD: Coronary Heart Disease
CRP: C-Reactive Protein
CT: Computerised Tomography
CVD: Cardiovascular Disease
DHI: Dietary History Interview
DXA: Dual Energy X-ray Absorptiometry
EBR: Evidence-Based Research
ESC: European Society of Cardiology
ESH: European Society of Hypertension
EU: European Union
FBS: Facility-Based Sampling
FFQ: Food Frequency Questionnaires
FPG: Fasting Plasma Glucose
GATT: General Agreement on Tariffs and Trade
GDM: Gestational Diabetes Mellitus
GPAQ: Global Physical Activity Questionnaire
HALE: Healthy Life Expectancy at birth
HDL-C: High Density Lipoprotein Cholesterol

IDF: International Diabetes Federation
IFCC: International Federation of Clinical Chemistry and Laboratory Medicine
IFWS: Indigenous Field Worker Sampling
IMT: Intima-Media Thickness
IPAQ: International Physical Activity Questionnaire
LE: Life Expectancy
LDL-C: Low Density Lipoproteins Cholesterol
MI: Myocardial Infraction
OGTT: Oral Glucose Tolerance Test
PICO: Population, Intervention, Comparison and Outcome
PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses
QFQ: Quantity Frequency Questionnaire
RDS: Respondent-Driven Sampling
SAD: Supine Sagittal Abdominal Diameter
SAT: Subcutaneous Abdominal Adipose Tissue
SIDS: Sudden Infant Death Syndrome
SOP: Standard Operating Procedures
TLS: Time-Location Sampling
TS: Targeted Sampling
UK: United Kingdom
UN: United Nations
US: United States
NHS: National Health System
VAT: Visceral Adipose Tissue
VLDL: Very Low Density Lipoproteins
WC: Waist Circumference
WHR: Waist to Hip Ratio
WHO: World Health Organisation
WTCRF: Wellcome Trust Clinical Research Facility

Chapter one: Dilemmas in research on ethnic minorities with special focus on the Iranian Diaspora

1.1 Introduction

Equity in health and access to health care are emphasised in many international mandates as a pivotal element of human rights. Even so substantial disparities still exist in the health of people with diverse ethnic background in several countries. Further to disparities in health of ethnic populations also there is inequity in the inclusion of ethnic minorities in research on health and health care.

A significant number of Iranians live in the United Kingdom (UK) including Scotland but we know very little about the prevalence of cardiovascular disease (CVD) risk factors in this population.

This chapter outlines the debates surrounding the issue of equity of health and access to health care for ethnic groups and reviews the international policy mandates in this regard. Main objectives of this study and its importance in sustaining of equity in health and access to health care for all subgroups of population in the UK and other European countries are also provided. Background information about Iran, its geography, population and economy and recent pattern of Iranians' emigration are also provided to support the rationale behind selection of the study topic.

1.2 Equity of health and access to health care for ethnic groups: international policy mandates

Healthy living is a universal desire regardless of biological, demographic, social or cultural background of human beings. Definitions of health and well-being may vary amongst communities and even individuals living in an identical community based on the

perceived definition of health or cultural and social beliefs. Even so equal right of everyone to be healthy and have access to health care is emphasised in prominent international agreements. In the Article 25 of the Universal Declaration of Human Rights (2) for instance having a standard level of living adequate for the health and well-being, access to medical care and necessary social services clearly is addressed and therefore it is incorporated as a sine qua non in other international legislation and policy mandates. The following few examples reflect the efforts made by the international community towards translating these rights into regulations:

- United Nations (UN) International Convention on the Elimination of All Forms of Racial Discrimination (January 1969). (3)
- Commonwealth Racial Discrimination Act 1975. (4)
- UK Race Relations Act 1976. (5)
- Race Relations (amendment) Act 2000. (6)
- Human Rights Act 1998. (7)
- NHS Department of Health Race Equality Scheme: 2005-2008. (8)
- Canadian Charter of Rights and Freedoms (incorporated as part of the Constitution of Canada in 1982). (9)
- European Union (EU) Race Equality Directive (2000/43/EC). (10)
- United States (US) Healthy People 2010 plan (document of the US Department of Health and Human Services, January 2000). (11)

It is commonly accepted that equity of health and access to health care does not exist for people with diverse ethnic background across countries. (12) Even in the developed world, the burden of diseases and their consequences is considerably varying among ethnic groups. Some of these variations are unavoidable and originated from divergences in the gene pool of different ethnic populations. Thus there is an international debate to explain the distinctions as an issue of natural biological phenomenon or simply as a social injustice that affect quality of health care for ethnic minorities. (13) In the former case it was argued that deficiencies in health care systems and inadequacy of health services in serving diverse target population should be scrutinised. It is a widely accepted value for a health care system to deliver equal health services regardless of

people's sex, age, race or ethnicity. That being the case, a person's ethnicity should not affect his/her chance to receive proper health services. Otherwise disparities in health between ethnic groups and indigenous populations can reflect major deficiencies of health care systems as a failure or presence of an institutionalised discrimination against ethnic groups in the given communities. Such a conclusion was highlighted properly in the recommendation of the European Union (EU) Committee of Ministers (8th November 2006) to the member states that "*...inequalities with regard to health care affecting ethnic groups are linked to problems of access, the lack of culture competence in health care providers, lack of essential provisions, all of which may be structural barriers to quality care...*". (14) All these discussions imply that ethnicity is a rising issue in the arena of health and health care provision and should be investigated in the associated scientific literature. But without an extensive shift in our approaches toward ethnicity and race neither local nor international ethical codes can prevent the consequences of so mentioned inequalities. (15)

1.3 Dilemmas in research on ethnic minorities

Easily understandable and internationally accepted criteria do not exist to label non-native people living in a designated host community. Therefore differing terminology was utilised in the literature to classify these people and their offspring within last decades. Terms like migrants, immigrants, ethnic minorities or settlers are widely used although their application may cause confusion from one country to another. (14) This variation has partly evolved from the complexity in labelling of our own group identity and with the same token from confusions in the assignment of group identity to others. For instance, we sometimes use cultural or biological factors equivalently to distinguish a group identity by a given label. (16)

Lack of consensus on a widely adoptable guideline to apply when incorporating ethnicity related terminology in health studies imposes certain challenges. (1) Race and ethnicity as a criterion to categorise population groups are sometimes employed in the literature synonymously. While race refers to biological attributes which generally distinguish a population with anatomical features, ethnicity mostly reflects cultural characteristics of a group. Having a common language or a set of traditions are popular

probes for ethnicity but with current pace of expansion in the cross-cultural marriages or extra marital relationships it will be very difficult to label successors of these mixed-culture families. Moreover offspring of migrants who are brought up in the host communities generally are more homogenous culturally with the indigenous population since they adopt the cultural norms, values, attitudes and behaviours of these communities from very early ages. Thus we may face individuals with biological features of one group and cultural characteristics of another group in a single community. As Braun et al. (17) have announced classification of ethnic groups in a stereotypical way when they are actually genetically or socio-culturally homogeneous will cause major bias in biomedical research. Many people may have their own subjective categorisation of ethnicity which is mainly shaped by connection between anatomical features, culture and socio-economic status. Therefore classification of ethnic groups by labels selected by a researcher may be considered to be inaccurate, offensive or even racist by people who may participate in a study. This could be a major barrier in collection of sound data about health of ethnic groups regardless of the place they are living. In addition there is a widespread concern about socio-political sensitivity of ethnic labelling to prevent stigmatising or endangering groups that are in the greater risk of illness. (18)

As a matter of fact there is now a mounting evidence about genetic homogeneity of human beings and that we are more like each other than many other species in the world. This implies that our genetic identity is derived from same ancestors. Interestingly the study by King et al. (19) has shown the hidden African ancestry of White men in Yorkshire. All these verifications indicate that cultural and social expressions should be applied in studies on ethnic groups rather than merely place of birth or biological features.

Despite these debates about precise classification of ethnic identity, it is commonly accepted that ethnicity could be an important variable to identify population variations in health related studies. (20) With such a background, cross-cultural medicine was introduced as a new approach in the medical science to highlight the interplay ethnicity has on health and wellbeing of different populations.

Yet, there are many unanswered questions posed by inequities in the health of divergent ethnic populations and it seems absurd to ignore this legitimate descriptor of health inequities in the research on health components. Furthermore in addition to disparities in health of ethnic populations there is also inequity in the inclusion of ethnicity in research on health and health care. This is partly entrenched in ambiguities in definition and classification of ethnicity and also more importantly in the lack of comprehensive knowledge about consequential effect of ethnic background on health. Institutionalised discrimination against ethnic minorities in some countries may also have effect on their lower representation in health research, divergent access to health cares or exposure to health risks. But in the absence of such a structural barrier and with current rigorous body of research evidence all population based studies on health should reflect diversity of the population to assure equitable provision of health care. This only will be achieved through the precise investigation of health needs within the divergent communities. (18)

1.4 Iran: A country profile

In this section general information about Iran's history, geography, population and economy were summarised using the several facets provided in the corresponding references. Later it was discussed that how these background characteristics affected shape and size of the Iranian minority groups in different countries of the world.

1.4.1 History

Iran has a diverse population and cultural structure which is rooted in its history. Until 21st of March 1935 Iran was known as Persia which is originated from the name of a region in the south of this country (Pars). Iran's history goes back to about 559 BC when Cyrus the Great established the first Iranian unified empire (Achaemenian Empire, 559-330 BC). (21, 22) He was the mastermind of Cyrus Cylinder known as the first statement of human rights, which is now in the British Museum of London. (23) Iranian empire under the rule of Cyrus the Great and his successor Darius the Great reached to its highest accomplishment as one of the largest and most powerful empires in human history. Thus one of the world's oldest civilisations was developed. This empire was destroyed by Alexander III of Macedon in 330 BC. (21, 22)

Iran in its later history was ruled by Parthian (247 BC-224 AD) and Sassanian (224-651 AD) dynasties. During the Sassanian period the last great Iranian empire was formed and its rich cultural heritage were expanded out virtually beyond the neighbouring countries. (21, 22)

Arab tribes invaded Iran in 637 AD and conquered it after several great battles in 651. During these battles some of the remarkable symbols of Iranian civilisation were destroyed. Zoroastrianism was the state religion before the seizure of Arabs but afterwards Iranians gradually converted to Islam. Even with drastic sabotage of the country's civilisation symbols, many of the Iran's achievements that time were adopted by Arab invaders. Therefore Persian Empire in the Sassanian period is believed to have major contribution to the Muslim world and global civilisation. (21, 22)

Iran was invaded by the Mongol leader Genghis Khan in the 13th century and subsequently Mongol dynasties ruled Iran for nearly two centuries. Safavieh Dynasty eventually created again a centralised Persian Empire in 1501. Shia Islam was established as the official religion of the Iran under the rule of this dynasty (Shias believe that after Prophet Muhammad the political leader of the Muslim world should be descended by one of infallible member of his family but according to the Sunni Islam the leader must be elected by Muslims). Iran was ruled by the Qajar Dynasty from 1796 until 1925 and after that by the Pahlavi Dynasty from 1925 to 1979. (24) The Pahlavi dynasty was overturned by an Islamic revolution which also was an end to the constitutional monarchy ruling system in this country.

1.4.2 Geography

Iran is situated in Southwest Asia bordering with Armenia, Azerbaijan, and Turkmenistan in North (including almost 650 kilometres of water along the southern shore of Caspian Sea), Turkey and Iraq in West, Afghanistan and Pakistan in East and the Persian Gulf and Gulf of Oman in South. Iran is the 18th largest country in the world with an area of 1,648,195 km² of which 12 000 km² is water (including a dozen islands in the Persian Gulf of them Abu Musa, Farsi, Hendurabi, Hormuz, Kharg, Kish, Lavan, Qeshm, Greater and lesser Tunbs are prominent). (24) Iran has a variable climate. In the northwest mountainous provinces (Ardabil, East & West Azerbaijan and Kurdistan),

winters are generally cold with heavy snowfall and freezing temperatures ideal for the region's ski resorts. In the south, winters are mild and the summers are very hot (temperature exceeding 40° Celsius) accompanied by high humidity. About one-tenth of the country is forested which are mostly scattered in the North and North West region. (21)

1.4.3 Population

Iran has a population of almost 69.6 million (25) and according to the latest available data annual population growth rate is 1%. (25) About 68% (26) of Iran's population is living in urban areas. This country is amongst the most receptive countries in the world with hosting an estimated 2.1 million refugees, 1.85 million of whom were from Afghanistan and 220,000 from Iraq. (27) Iran has a young population since about 29% of its population is under 15. (26) The overall life expectancy was reported to be 70.0 years: 68 years for men, 72 years for women in 2004. (28) Adult mortality rate was 190 (per 1000) for males and 118 (per 1000) for females in 2004 and according to the provided statistics ischaemic heart disease was the leading cause (21%) of death in 2002. (28) Under five mortality rate (per 1000 live births) was 38 in 2004 and maternal mortality rate (per 100000 live births) was reported to be 76 in 2000. (28) Total fertility rate and annual population growth rate was 2 and 1% respectively in 2004. (25)

As discussed earlier Iran is a multi-ethnic and multicultural country. Persian language is official spoken language not only in Iran but also in Afghanistan and Tajikistan and is prevalently spoken in other countries like Uzbekistan and Bahrain. Historically the term "Persians" has used to label all groups of people having origin in the Iranian Plateau. Therefore, this term includes all subgroups of Iranians even with various regional languages or dialects. (21, 22) These sub-groups are identified primarily with their distinctly Iranian language, and/or culture but they also can be labelled by their secondary ethnic, religious, linguistic, or regional backgrounds. The main ethno-linguistic minority groups in Iran are: Fars 51%, Azeri 24%, Gilaki and Mazandarani 8%, Kurd 7%, Arab 3%, Lur 2%, Baloch 2%, Turkmen 2%, other 1%. (21, 22) All of these groups speak Persian as the national language but have their own languages and cultures as their sub-identity and as an asset for their ancient civilisation. Thus as

Professor Richard Frye stated “... *the mosaic of peoples living in Iran today reflects the central geographical situation of the country throughout history, frequently described as a crossroads of Eurasia.*” (29)

1.4.4 Economy

Iran is one of the main oil exporters in the Middle East region with possessing almost 10% of the world's total proven petroleum reserves. This country also has the second greatest natural gas reserves after Russia. With this background the country's economy is heavily dependant on oil and gas industry. Even so, major progresses have taken place in the car, textile, metal manufacturing and food processing industries in recent years. (30, 31) Despite having such a substantial potential, Iran's economy suffers from a chronic inefficiency due to the improper economic policies. Distribution of fuel and other energy carriers in heavily subsidised rates or deficient income tax system are only examples of strains in the country's economy. General government expenditure on health was estimated to be 9.6% in 2004. (26)

1.5 Iranian Diaspora: Past, present and future

Migration of Iranians is deeply entrenched in the history of this country. Turbulence in the political, economic and social status following the replacement of central governments or major wars all were main causes of migration from Iran. For instance a group of Iranians (mostly follower of Zoroastrianism) migrated to western India to save their lives and possessions after invasion of the Arab tribes in 637 AD. They are now called Parsis (originated from Persia the old name of Iran) and form one of the major ethnic groups in India. (32, 33)

In more recent decades there was a gradual shift in the composition, size and the motivation of Iranian migrants. Some of the Iranian high profile intellectuals left the country following the tribulations leading to the Constitutional Revolution in the late 19th century (1905-1911). (34) After this period two major waves of emigration have happened in Iran. The first one started from 1950 and continued until 1979 during which youngsters mostly from middle and higher class families were sent abroad for higher education. This was consequence of the country's gradual economic recovery and rocketing revenues due to rise in oil prices. The number of Iranian students reached its

highest peak in the late 1970s and according to the official sources about 100,000 Iranians were studying abroad in 1977-1978 academic year, of which 36,220 were enrolled in the United States and rest of them mainly in the United Kingdom, West Germany, France, Austria and Italy. (35) It is estimated that the number of Iranian students that time was greater than the number of students from any other country in the United States. (35) Many of these students remained in the destination countries with their families and created the first sizable Iranian ethnic groups in these host countries.

The second wave of the Iranians' emigration started in early 1979 and accelerated following the start of an eight year war between Iran and Iraq in 1980. This twist in the history of emigration from Iran is undoubtedly regarded as the largest collective migration of Iranians from their country.

According to the US Census Bureau, there were approximately 283,225 foreign-born Iranians living in the United States in 2000. (35) The number of admitted Iranian immigrants to the United States was reported to be 192510 people from 1990-2005. (36) According to the Office of Immigration Statistics (OIS) overall 356,642 Iranian-born immigrants were admitted to the United States from 1970 to 2004. Approximately half of these migrants are living in the state of California with more concentration in Los Angeles and San Francisco. (35) The number of admitted Iranian immigrants was 21150 in the UK from 1991-2005, (37) 18034 in Sweden from 1992-2003, (38) 2095 in Norway from 1999-2001, (39) 14784 in Netherlands from 1995-2002, (40) 63295 in Germany from 1994-2003, (41) 8505 in Denmark from 1980-89, (42) 89191 in Canada from 1990-2004, (43) 7814 in Austria from 1996-2001, (44) 11008 in Australia from 1991-2005, (45). Thus with adding all these numbers together, about 592518 Iranians have migrated to these countries during the mentioned period of times. The number obviously excludes many other countries and time periods for which reliable data was not provided. Moreover these numbers do not include offspring of Iranians within the host communities. Thus while a considerable and growing population of Iranian migrants has shaped throughout the world we know very few about their health in general and their cardiovascular risk status specifically.

The diversity of Iran's original population and its cultural heterogeneity is reflected in the socio-cultural features of the Iranian ethnic groups living abroad. So their first language, culture, life style and even motivation to migrate can be different. Cross cultural marriages also added further to this complexity. The heterogeneity along with the extent of territories in the ancient Persian Empire had also impact on the variety of names and family names Iranian possess. On this account it is difficult to spot an Iranian migrant by his/her name or family name. Some of Iranian migrants especially those who fled the country due to political reason depending on their legal status or political affiliation may not want to make known their identity to their counterparts. Ultimately while migrants in general are considered to be hard-to-reach population, lack of cohesion among the Iranian migrants will warrant careful application of recruitment strategies when doing population based research in this ethnic group.

1.6 Focus, aims and objectives of this research

Cardiovascular disease (CVD) is a major cause of death and morbidity throughout the world and ranks as the leading cause of death in many countries. Almost 7.2 million people (46) have died globally in 2002 as a result of coronary heart disease (CHD) and 5.5 million (46) as a result of stroke which are the consequences of disruption in the blood vessels supplying the heart muscle or brain.

Findings of several studies in the developed countries have indicated that the prevalence of CVD risk factors among migrants is different from the general population and also from the population of the country of origin. (47-51)

As explained previously Iran with a population of over 69 million (25) is changing rapidly towards industrialisation. Although a sizable number of Iranians reside across the UK (37) including Scotland we know very little about the prevalence of CVD risk factors in this population.

This thesis reports findings of a pilot population-based research on the prevalence of conventional CVD risk factors amongst Iranians living in Edinburgh as the first study of its kind ever undertaken in the UK. The thesis also outlines main findings of the two conducted systematic reviews. As a preliminary work a systematic review was carried out to provide a comprehensive tabulation of available data on recruitment methods that

have been used successfully in studies on the Iranian minority groups living abroad. It was based on the findings of this systematic review that a decision about useful recruitment methods in this pilot study was made. Another systematic review with meta-analysis also was implemented on the prevalence studies of CVD risk factors amongst Iranians in order to have a reliable estimate on the prevalence of these risk factors and also to decide on the study variables. Findings of this pilot study will be important to develop methods, gain experience and to acquire estimates to inform a larger future study. In the same way these findings will help efforts to control CVD in Iranians living in the UK and similar European countries. A future full scale study in this subject could be enlightening for health care policy makers and will be influential in decision making about efficient allocation of resources to control CVD risk factors.

1.7 The layout of the thesis

In this chapter the issue of equity of health and access to health care for ethnic groups was reviewed in the context of international policy mandates. Main objectives of the study and its importance in sustaining of equity in health and access to health care for all subgroups of population in the UK and other European countries were also provided. Summary information about Iran, its geography, population and economy and recent pattern of Iranians' emigration were also discussed to support the rationale behind selection of the study topic.

Chapter two focuses on the global burden of cardiovascular diseases, diversities in cardiovascular health among migrant population and methodological considerations in epidemiological studies of major cardiovascular risk factors. Techniques to recruit hard-to-reach populations and role of systematic reviews and meta-analysis in practising evidence based approach when doing research on health issues are also discussed.

Chapter three illustrates protocol and results of a systematic review on the methods and themes of health-related research on the Iranian Diaspora as one of the preliminary works carried out to gain experiences to apply in this pilot study and also in the future planned epidemiological researches.

Chapter four indicates protocol and results of another systematic review implemented to have an overall estimate from the prevalence of major CVD risk factors among

Iranians. This review also attempts to assess accuracy and the quality of the methods used in possibly all studies on the prevalence of CVD risk factors among Iranians.

Chapter five outlines the processes and methods carried out to achieve the aims of the pilot study, i.e. the study questionnaires, the research design and the analysis plan.

Chapter six describes the results of the fieldwork including the demographic characteristics of the study sample and the prevalence of the major cardiovascular risk factors in this group. Participants' ideas about the study and the applied questionnaires are also demonstrated in this chapter.

Chapter seven displays comparatively the prevalence of major CVD risk factors among Iranians in Iran, Iranians in Edinburgh and Edinburgh's White population.

Chapter eight as the final chapter in context of the study aims gives an extensive overview about what this study added to the scientific literature in relation to the health of Iranian ethnic minorities throughout the world and also about implications this study may have on the ways any future large scale study on Iranian migrants can be conducted.

1.8 Summary

There is mounting evidence to confirm that ethnicity is a rising issue in the arena of health and health care provision and should be scrutinised in the associated scientific literatures. It is commonly accepted that equity of health and access to health care does not exist for people with diverse ethnic background across countries. Equitable provision of health care will be achieved only through the precise investigation of health needs within the divergent communities.

Findings of several studies in the developed countries have indicated that the prevalence of CVD risk factors among migrants is different from indigenous population and also from the population of the country of origin. A significant number of Iranians reside across the UK including Scotland but we know very little about their health and the prevalence of CVD risk factors in this population. While migrants in general are considered to be hard-to-reach populations, lack of cohesion among the Iranian migrants will warrant application of more efficient recruitment strategies when doing population based research in this ethnic group.

This thesis reports about a pilot population-based study about the prevalence of major CVD risk factors amongst Iranians living in Edinburgh as the first study of its kind ever undertaken in the UK. The findings will be important to develop methods, gain experience and to acquire estimates to inform a larger future study. In the same way these findings will help efforts to control CVD in Iranians living in the UK and similar European countries. In the next chapter global burden of cardiovascular diseases and methodological considerations in epidemiological studies of major cardiovascular risk factors are discussed. Techniques to recruit hard-to-reach populations and the role evidence based approach can play in extending boundaries of our current knowledge are also outlined.

Chapter two: Literature review: important considerations in epidemiological studies of cardiovascular risk factors, recruitment of hard-to-reach populations and use of scientific evidence to inform research

2.1 Introduction

Despite considerable progress in the detection and treatment of cardiovascular diseases (CVD) in recent decades, still more people are losing their lives from CVD than any other disease in many parts of the world. There are many unanswered questions about the pattern of morbidity and mortality from cardiovascular disease. Major disparities have been reported to exist between different countries and even among subgroups of populations within a defined geographical region. In the previous chapter issues of equity of health and access to health care for ethnic groups were discussed. Diversities in cardiovascular health among migrant population and dilemmas in research on ethnic minorities also were outlined. This chapter focuses on diversities in cardiovascular health of migrants with special emphasis on the methodological issues surrounding the study of major cardiovascular risk factors. Recruitment methods of migrants as generally one of the hard-to-reach populations and importance of applying an evidence based approach in research on health issues are also reviewed.

2.2 Global burden of cardiovascular diseases

Our knowledge about determinants and consequences of cardiovascular diseases (CVD) have extensively improved in recent years but still CVD takes lives of more people than any other disease in several countries of the world. (52) About 16.7 million individuals (46) from those who develop heart attacks, strokes or other types of CVD die each year while many of these deaths are preventable. Putting proper measures into

action to lower prevalence of predisposing factors such as hypertension, diabetes, smoking, high blood lipids or physical inactivity have contributed to a sharp decline of CVD related mortality in some developed countries, but CVD nevertheless remains the leading cause of death and morbidity in the developed world and also in many other developing countries. (52) Thus CVD extended beyond geographic and socio-economic boundaries for instance by taking lives of almost 267 individuals per 100000 within the countries of European Union (EU) every year. (53) According to the data available for 2002 (54) France (118) and Spain (137) had lowest CVD related age-adjusted mortality rate and Czech Republic (315) with Greece (258) the highest rate per 100000 of population. In the Middle East region where major oil rich countries with high income rates are located, age-adjusted CVD related mortality is even higher than most of the European countries and in 2002 it was reported to be 369 for United Arab Emirates, 309 for Kuwait, 405 for Saudi Arabia and 466 for Iran per 100000 of their population. (54) All these figures are illuminating the scope of trouble CVD created to the civil societies regardless of the socio-economic status.

Even though CVD caused almost a third of global deaths yet about 80% of these deaths (55) have occurred in developing countries. According to the World Health Organisation's predictions CVD will be the leading cause of death in developing countries by 2010, (56, 57) whilst many developing countries already have reached this level.

Economic transitions have precipitated urbanisation and lifestyle changes in the developing countries which are triggering, in turn, poor behavioural patterns. Unfortunately unhealthy consequences of globalisation such as fast food epidemic have reached into developing world very much faster than the favourable aspects. For instance global trade and taxation laws such as the General Agreement on Tariffs and Trade (typically abbreviated GATT) have made access to harmful products like tobacco very easy in these countries. Tobacco use has precipitated about 6% of all global mortality at 1990. Tobacco related mortality was 4.9 million in 2001 and is estimated to reach 10 million by 2020. (56) These figures show how important can be health burden of economic policies in addition to other consequences. Tobacco industry generates

substantial amounts of profits and tax revenues for producer and importer countries but in developing countries this is not comparable with the direct and indirect burden of tobacco use. Thus CVD control programmes can be potentially hampered by controversial policies of other sectors especially in developing countries where there are a background inadequacy of health system infrastructure and shortage of resources. Overall cost of CVD was estimated to be about €168757 million for EU and €36550 million for UK in 2003. (58) Economic impact of CVD in low and middle income countries can be complicated and even worsen their fragile health condition due to competing health priorities. (59) Therefore without critical reassessment of policies in all community sectors considerable progress in control of CVD epidemic can not be achievable. CVD can significantly affect both healthy life expectancy at birth (HALE: the number of years a person can expect to live in good health and free from disease) and life expectancy (LE) due to abrupt death following a myocardial infarction or stroke. Thus without revising of current general and public health policies in these groups of countries quality of life for mostly deprived and poor people will be worse than current conditions due to growing pattern of CVD pandemic. Consequently, many people will pay cost of defective international and national policies with their lives.

2.3 Diversity in cardiovascular health among migrant populations:

few examples to highlight magnitude of the problem

While cardiovascular disease still is the leading cause of death and morbidity in many part of the world but considerable achievements have been made in reduction of CVD mortality since the 1980s. Major part of this success is due to the relative progress in recognition of high risk groups and also implementation of interventional programmes to control the contributing risk factors. But this reduction has not occurred equally in countries across the world and even within an individual country. (60) CVD mortality and morbidity currently is higher in developing countries than the developed world and it is predicted that the gap will be extended beyond the present levels in the future. (57) But currently in the both groups of countries such a gap is seen between population sub groups too. This disparity was attributed in the literature to genetic, differences in the

associated risk factors and the variations in the socio-economic or environmental features. However; a considerable amount of uncertainty still remains to be resolved.

With recent accelerated pace of migration from developing world a sizeable number of ethnic groups were formed in the developed countries. Most importantly distinct divergences in CVD mortality and morbidity rates have been reported in the immigrant population of these countries. (61) Differing genetic characteristics, exposure to variety of predisposing factors in their country of origin along with maintaining of a certain cultural beliefs and customs are considered to be main contributing factors for the observed variation.

Dotevall et al. (62) in their study on the immigrant population (those from Finland and those originated from other regions of the world including the Balkans and Turkey, Middle East, Central/Eastern Europe and Western Europe) of Sweden have reported that they have a worse CVD risk profile than Swedes owing to higher levels of predisposing risk factors such as body mass index (BMI), waist to hip ratio (WHR), low density lipoprotein (LDL-C) and smoking rate. According to the findings of this study Finnish immigrants had higher blood pressure than Swedes. Finnish men also had a higher level of total and LDL-cholesterol but in non-Finnish immigrants of both genders level of HDL-cholesterol reported to be significantly lower while level of triglycerides significantly was higher. Another study in Sweden by Gadd et al. (63) have revealed that foreign born migrants (classified in 12 subgroups according to their country of origin) have higher risk of CVD and coronary heart disease (CHD) than the indigenous population regardless of education level and employment status. For instance according to the findings of this study Iranian migrants even after adjusting for age, education and employment status indicated a higher risk of coronary heart disease (CHD) compared to Swedes in both gender. Gadd et al. (61) also suggested in another study that the majority of immigrant groups (coming from Denmark, Norway, Finland, Germany, Southern Europe, Chile, Poland and Hungary) have lower all-cause mortality risk of CHD in Sweden than their original countries. Hedlund et al. (64) reported that foreign born immigrants in Sweden (born in Finland, other Nordic countries, Poland, Turkey, Syria and South Asia) have higher incidence of first myocardial infraction (MI) than the

indigenous population which persist even several years after immigration. They have concluded that this pattern is not explainable by differences in the socio-economic status.

Cappuccio (65) has shown that mortality from stroke is high amongst black migrants to UK (both Caribbeans and West Africans) while CHD mortality is low in this group (compared to general White population). He discussed that such a pattern might be associated mostly with high prevalence of hypertension and diabetes since other conventional CVD risk factors like smoking and hypercholesterolaemia are less prevalent in this group. Thus he addressed genetic susceptibility and gene-environment interplays in his paper which should be considered when studying ethnic groups especially when we also see a consistent pattern of the disease in subsequent generations of the migrants across the world.

Brindle et al. (66) indicated in their study on seven British Black and ethnic groups that 10-year risk of CHD and CVD for non-smoking people aged over 50 years with a systolic blood pressure of 130 mmHg and a total cholesterol to high density lipoprotein cholesterol ratio of 4.2 were highest for Pakistani and Bangladeshi men and CHD risk were lowest in Caribbean men. According to the findings of this study CVD risk was lowest in Chinese.

Notwithstanding with the findings of the study was conducted by Cappuccio (65) (which indicated a high CHD and stroke mortality among South Asians settled in the UK), Bhopal et al. (67) discussed South Asians' risk status in detail. In this article the authors explained that South Asians consisting of Indians, Pakistanis and Bangladeshis are not homogenous with regard to the risk of coronary heart disease. Bangladeshis were reported in this article to have the lowest socio-economic status. Accordingly it was shown that they have the highest concentrations of triglycerides and fasting blood glucose. Pakistanis also were reported in this study to be in greater risk of CHD due to high prevalence of contributing risk factors in comparison to Indians and indigenous population. The sex-specific standardised mortality ratio due to circulatory disease which was estimated by Wild et al. (68) (using deaths data from 2001 onwards) for

Bangladeshis and Pakistanis confirms higher overall CVD related mortality rate in the both ethnic groups.

All these examples are suggesting that migrant population in many countries of the world have considerably diverse cardiovascular health compared to indigenous population. They are also implying that such a gap should mostly be attributed to variations in the contributing risk factors within migrant population.

2.4 Major cardiovascular risk factors and their measurement methods in epidemiological studies

Existence of multiple definitions and standards for measuring CVD risk factor has caused confusion and impeded comparison of the results from different research papers. Thus, trends of cardiovascular risks over time in many countries and merits of interventional programmes to control influential constituents of the pathologic phenomenon are not provable precisely. Heterogeneity of the applied measurement protocols in the CVD related health studies and the types of studied CVD markers may also cause major biases in the calculation of overall summary measures and thus distort the policies that will be sought upon the findings. Therefore it is crucial to base CVD studies on a sound methodology and take into account all possible confounding factors in measurement of the conventional CVD risk factors. In the absence of internationally agreed guidelines to investigate epidemiological attributes of CVD, findings from scattered studies will not contribute thoroughly to the disease control and prevention. Major studied CVD risk factors and important recommendations to be considered in their measurement are discussed below.

2.4.1 Hypertension

Hypertension is one of the major predictors for an important group of cardiovascular incidents which can precipitate critical conditions in several organs of the body. Therefore accurate measurement of blood pressure is the basis for control and management of cardiovascular disease and other related complications. Imprecise measurement of blood pressure can cost lives and despite its wide application for more than a century still there are important debates about reliability of blood pressure measurements. (69) Inferior standardisation of blood pressure measurement techniques,

lack of harmony amongst different guidelines and on the other hand existence of major discrepancies between present guidelines and training of medical profession in the educational institutions all have raised concerns in efforts to control hypertension. (70) While using of a reliable device is a basic prerequisite for an accurate blood pressure measurement other influential factors are measurement circumstances like time, position, location, temperature and frequency, patient related characteristics e. g. age, race, use of tobacco or alcoholic drinks, having meals or exercise, pain or bladder distension, patients' emotions and finally measurer related factors e. g. scale of proficiency, precision and implicit bias. (71) The following are the main recommendations to lower measurement bias based on internationally proven practice guidelines to measure blood pressure accurately:

White-coat effect: Refers to a physiological reaction caused by anxiety and is commonly seen in the hospitals or outpatient departments when measuring of a frightened or anxious patient's blood pressure. Anxiety can increase blood pressure as much as 30 mmHg (72) in a normotensive or hypertensive individual. Thus the level of measured blood pressure will be greater than the blood pressure values obtained outside the medical environment. Therefore all attempts should be made to reduce fear and anxiety of individuals before measuring their blood pressure. Selecting of cosy room to measure blood pressure in a comfortable and relaxed position, talking non medical issues for a few minutes before starting measurement could lessen this fear. (71)

Attitude and posture of subject: To have a reliable blood pressure measurement subjects should be encouraged to relax and be advised not to talk shortly before and during the measurement. Blood pressure values slightly decline from lying to sitting or standing positions. (72) In order to standardise posture, in practice it is recommended to measure blood pressure in the sitting position with back support, legs uncrossed and the arm supported at heart level (positioning arm below heart level overestimates and rising it above heart level underestimates the systolic and diastolic blood pressure). It is also suggested to ask subjects to remain for 5 minutes in their sitting position before doing the measurements. (72) The task force for the management of arterial hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology

(ESC) published guidelines (2007) recommend taking of at least two measurements spaced by 1-2 minutes, and an additional measurements if the two first measurements were considerably different. (73) Due to inter-arm differences of systolic and diastolic blood pressure it is also recommended to measure it in both arms at first visit and take the higher value as the reference. If the differences be greater than 20 mmHg for systolic and 10 mmHg for diastolic pressure on consecutive readings to detect possible peripheral vascular disease, subjects should be referred to a specialised centre. (72, 73)

The cuff and bladder: In the conventional Riva-Rocci/Korotkoff technique to measure ambulatory blood pressure (ABP) majority of applicable devices are dependent on an elastic cloth containing an inflatable rubber bladder that encircles the arm. A standard cuff size is 12-13 cm long and 35 cm wide according to ESH and ESC guidelines (73) however; the standards given by the British Hypertension Society (BHS) (74) and the American Heart Association (AHA) (75) are different. Relative to the subjects' arm circumferences it is also possible to use a shorter (e.g. for children) or longer cuff (e. g. for obese people). Too narrow or short bladder could cause overestimation and too wide or long bladder could cause underestimation in blood pressure measurement. (72) The cuff should be placed 2-3 cm over the arterial pulsation after palpation of the brachial artery in the ante-cubital fossa on the subjects' bare upper arm. It is also should be noticed that the sleeve not be rolled up in a way that has a tourniquet effect above the cuff. The tubing from the device to the cuff must be of sufficient length (70 cm or more) and the cuff must be inflated to at least 30 mmHg above the point at which the radial pulse disappears. The rate of cuff deflation is recommended to be 2 to 3 mmHg per second. (75)

Blood pressure conventional measurement devices: Accurate measurement of blood pressure is highly dependent on the equipment used. Mercury sphygmomanometers were routine devices in measuring blood pressure until recently but automated sphygmomanometers are replacing very rapidly on the basis of concerns about the toxicity of mercury, error inherent in the oscillometric method and need to repeated and expensive training of health care professionals. Even so still there are debates on usefulness of automated devices in clinical settings to measure blood

pressure accurately. The fact that available devices are giving systematically different results than those obtained by mercury sphygmomanometers and especially their limitations to measure reliable blood pressure in patients with arrhythmias have retained mercury sphygmomanometers as a gold standard for many. (72) On the other hand most of the available epidemiologic data are based on the measurements taken by mercury sphygmomanometer which makes their comparison with the data coming from automated devices very difficult. Therefore it is recommended to use same measurement method if the main objective of a research is to make comparisons with other studies. (76) Advantages of automated devices such as being easy to use even in conditions not favourable to good practice and reduction of measurer bias (due to systemic error, terminal digit preference or observer prejudice) have led many researchers and health care providers to switch from application of mercury sphygmomanometers to automated devices. But right decision will be made only with contemplating of the instruments' usefulness in differing circumstances and noticing the main objectives of blood pressure measurement in practice. (76)

Other important issues to consider for a reliable blood pressure measure: In addition to the discussed tips to have a reliable blood pressure measure there are a number of other recommendations in the literature to be applied in CVD studies. A phenomenon called masked hypertension refers to a state in which individuals with normal clinic blood pressure show an elevated value at home. (77-80) It is reported that about 1 in every 7-8 subjects with normal blood pressure in clinic may fall into this category. (79) Another issue is the influence of physical and mental stressors on blood pressure. For instance it has been shown that physical activity (dynamic or static exercise) or mental engagement (due to a problem of daily life or with technical and decisional nature) may increase blood pressure. (73) Thus riding of a bike or climbing stairs before attending a clinic for CVD risk assessment may raise up blood pressure. Other stressors like outdoor (causing seasonal variation) or room temperature (81-83) and performing a painful procedure before measurement of blood pressure all will have same effect on blood pressure. (84)

2.4.2 Smoking

Smoking is one of the major risk factors for CVD and accounted as a precipitating constituent for about 20% of CVD cases worldwide through mostly damaging the endothelium lining of the arteries, increasing the cholesterol plaques, intensifying clotting, elevating low density lipoprotein (LDL-C) and reducing high density lipoprotein level and also by promoting coronary artery spasm. (46) Tobacco use was estimated to be main cause of death of more than five million people in 2008 which is more than the total number of deaths due to AIDS, malaria and tuberculosis together. (85) Mathers and Loncar (86) predicted that total tobacco-attributable mortality will rise from 5.4 million in 2005 to 8.3 million and according to the pessimistic scenario to 9.7 million in 2030. They also have envisaged that in 2015 smoking will be accountable for 10% of all deaths worldwide and kill 50% more people than AIDS (Acquired Immunodeficiency Syndrome). By that time it is anticipated that deaths caused by smoking will double from current 3.4 million to 6.8 million in low and middle income countries. (86) Thus while about 75% of the world's tobacco market is controlled by just four companies based in the developed world, (87) smokers in the developing countries will ensure profits of these corporations with their lives.

Based on the World Health Organisation standardised guidelines for measurement of smoking (88) people can be categorised into main groups and within each group into number of subgroups. Smokers and non-smokers are the main classifying labels.

A smoker is a person who smokes any tobacco product on a daily basis (at least once a day) or occasionally (not every day). Occasional smokers themselves can be a reducer (used to smoke daily but currently smoke occasionally), continuing occasional smoker (has never smoked on the daily basis but has smoked at least 100 cigarettes or the equivalent of tobacco) and experimenter (has smoked fewer than 100 cigarettes or the equivalent of tobacco). (88)

A non-smoker is a person who does not smoke at the time of questioning but he/she can be an ex-smoker (formerly a daily smoker who has stoped smoking), ex-occasional smoker (formerly an occasional smoker who has never been a daily smoker but has smoked 100 or more cigarettes or the equivalent amount of tobacco in his/her lifetime)

or never smoker (a person who has never smoked or has smoked less than 100 cigarettes or the equivalent amount of tobacco in his/her lifetime). (88)

Self reporting and biochemical measurement are two main data gathering methods that are being applied in many studies to clarify smoking habits in different population. There are several reports suggesting the underreporting of smoking (89-91) which generally is believed to be the result of socio-cultural desirability of non-smoking or presence of a stigma with smoking which inhibits people to explore their smoking behaviour accurately. If self reporting will be chosen as the proxy for smoking status it is recommended that the questions should include starting age and age of stopping (if smoking stopped), type of smoking (manufactured or hand made cigarette, pipe, cigar or hubble-bubble) and the quantity used. (76) Also questions about passive smoking should be asked if the study targets CVD and its risk factors.

Amount of carbon monoxide in breath also can be measured as a biomarker of smoking in CVD studies. This method is a very cheap and simple technique and applicable by using a portable monitor. Thiocyanate levels in serum, urine or saliva and cotinine levels in plasma or urine are other biomarkers of smoking. Thiocyanate levels are prone to unusually high cyanide content of diet (is found in cabbage or cassava). Cotinine levels in plasma are sensitive to all source of smoking (passive smoking, chewing or sniffing tobacco) however; its application is very much expensive than the other methods. So it is suggested that measurement of carbon monoxide in breath can be as accurate as other methods in detecting smokers from non-smokers and there is no indication to apply other expensive methods in population based prevalence studies. (76)

2.4.3 Physical inactivity

Physical inactivity is a global health concern and as an independent risk factor for many chronic illnesses it is estimated to be the main precipitating factor of 1.9 million deaths globally. (92) Intensity and frequency of our daily physical activities play a key role in our body's energy balance and so have a pivotal role in weight control and consequences of being overweight. Thus it is suggested that adequate physical activity can reduce the risk of coronary heart disease, type II diabetes, colon cancer and breast cancer in women in addition to its beneficial effect on mental health. (93) Different

intensity and amount of physical activity is required in order to maintain a healthy life. WHO suggests that at least 30 minutes of regular physical activity with moderate intensity in five days of the week reduce the risk of CVD and diabetes, colon and breast cancer but more activity is needed for weight control. (93)

Several questionnaires are generally being used to assess level of physical activity in populations whereas a standardised approach does not exist. In response to the need for developing of an international standard tool to measure physical activity different versions of physical activity questionnaires were developed in recent years. International Physical Activity Questionnaire (IPAQ) (94) and Global Physical Activity Questionnaire (GPAQ) (95) are routinely used questionnaires worldwide. Main determinants of these questionnaires are queries about levels of activity at work, during travel to and from places, frequency and intensity of recreational activities and also sedentary behaviour.

The main objectives of applying these questionnaires in the population level are to estimate total energy expenditure and extent of vigorous activity. (76) The major concern in application of these self report or recall questionnaires is their reliability and validity on different populations. IPAQ has been tested in 12 countries and its reliability and validity was verified. (96) GPAQ also has been validated in nine countries (CPAQv1). (97) There are also other questionnaires to assess physical activity level in population based studies (e.g. physical activity module in Health Surveys for England and Scottish Health Survey 2003) (98) but they are not validated to be applicable internationally.

Accurate and reliable assessment of physical activity by application of even validated questionnaires is not straightforward. Remembering activities with low intensity or those not done routinely generally are not easy for respondents. So it is argued that questions about physical inactivity may provide more information than the questions about activities in the past. (76) Over reporting of the activities' frequency or their intensity are another challenges in utilisation of self report questionnaires. There is a tendency among respondents generally to present themselves in a positive light by giving socially desirable answers. (99) This phenomenon can potentially affect validity of self report questionnaires to describe pattern of physical activity in a community. Other methods

developed for measurement of physical activity have their own limitations. For instance motion sensors (e.g. pedometers) are expensive and are not easily applicable in large population based studies. Heart rate monitors that should be used for at least 5 days to obtain average energy expenditure are also expensive and their use is not recommended in population based studies. The double labeled water technique in which the production of carbon dioxide is estimated from the rates at which stable isotopes of hydrogen and oxygen are replaced in the body water space is also expensive and can not be used in large scale population based studies. (76)

Sociocultural characteristics and the economic status of a given society may have substantial effect on the extent of physical activity therefore all these prominent factors should be considered in addition to the reliable assessment technique to investigate pattern of physical activity.

2.4.4 Hyperlipidaemia

Hyperlipidaemia refers to an abnormality which is characterised by raised serum lipid profiles. Such an elevation may occur in total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C) or triglycerides (TGs). Also the term dyslipidaemia is widely used in the literature to explain this phenomenon. However, the later term generally covers a broader range of irregularities in serum lipids including abnormally low level of high-density lipoprotein cholesterol (HDL-C). Lipids are insoluble in water and to be transported around the body they bind with protein molecules and form water soluble lipoproteins. These lipoprotein complexes are categorised into different classes with respect to their size and density. Starting with larger and less dense chylomicrons other classes in descending order are very low density lipoproteins (VLDL), intermediate-density lipoproteins (IDL), low density lipoproteins (LDL), high density lipoproteins (HDL) and lipoprotein a [LP(a)] which is a complex of LDL-C and an apoprotein B-100. (100) As the constituents of the plasma lipoproteins there are also lipid-binding proteins called apoproteins which transfer dietary lipids through the bloodstream from the intestine to the liver, and endogenously synthesised lipids from the liver to tissues. Acting as an enzyme co-factor, receptor ligand and lipid transfer carrier lipoproteins regulate the intravascular metabolism of lipoproteins and their target tissue

uptake. Based on their function in different lipoproteins, apoproteins are classified into six main classes and several subclasses. The main classes and subclasses of apoproteins are: A (apo A-I, apo A-II and apo A-IV), B (apo B48 and apo B100), C (apo C-I, apo C-II and apo C-III), D, cholesterol ester transfer protein (CETP) and apoproteins E. (101)

The relationship between plasma lipids and CVD is well established in many studies but the exact mechanism of this interrelation is still the subject of intense research. (102) The question to be asked is whether the disease process should be assessed by measuring the lipoproteins or the lipids carried within them. With the development of a method to analyse lipoproteins which is called nuclear magnetic resonance (NMR) it is now possible to measure their size and quantity in every individual subject. (103) This landmark technological progress has produced distinct improvements in our knowledge about the role of different lipoproteins in the development of CVD. It was indicated for instance that LDL-C values do not accurately reflect the number of circulating LDL particles and the risk of associated coronary artery disease. (102) It was also argued that the extent of atherosclerotic disease and its consequent CVD vary substantially between individuals with similar lipid profiles. (100) Nuclear magnetic resonance lipoprotein profiling has displayed that all LDL-C or HDL-C particles are not same and their size and quantity may vary from subject to subject. (103-110)

With considering all these in mind a measured LDL-C level may or may not be a reliable indication to concern unless the number of LDL particles carrying the cholesterol is markedly increased. (103) LDL-Cs are a heterogeneous group of particles with variable size and density. LDL-C₁ is the largest and least dense particle with greater amount of cholesterol, LDL-C₂ is the intermediate and LDL-C₃ is the smallest and most dense particle with lower amount of cholesterol in this group. All LDL-C particles have a apolipoprotein B in their molecule irrespective of their cholesterol content. It has been shown that between two subjects with the same LDL-C level, the one which has predominantly higher level of LDL-C₃ will be in greater risk of CVD. (100, 111))

Therefore it is suggested in some studies (112-116) that apolipoprotein B or ratio of apolipoprotein B to apolipoprotein A-I can be measured as a predictor for CVD. They do not need to be measured in fasting status and it is recommended that apolipoprotein B

measurement have a better predictive value than LDL-C or non-HDL-C alone. It is also argued that TC loses its predictive value in people over 70 years but apolipoprotein B or ratio of apolipoprotein B to apolipoprotein A-I is even applicable in this age group. (115) In addition where LDL-C level is in the normal range apolipoprotein B can be used to predict a fatal myocardial incident. Thus those people who have normal concentration of LDL-C but concurrently high level of apolipoprotein B are in greater risk of CVD than people who have higher level of LDL-C but low concentration of apolipoprotein B. (115)

It is believed that disruption in the normal physiology of lipids in human body can lead to excessive accumulation of LDL-C in the arterial walls which in turn is the primary stimuli for atherosclerotic lesions. Accumulated LDL-Cs in the arterial wall transfer into the monolayer endothelial cells that is concurrent with their modest oxidation inside the cells. Such a change in the arterial endothelium cells can activate an inflammatory reaction that proves inflammatory nature of atherosclerosis. (100) Thus C-reactive protein (CRP) as an inflammatory marker (is produced in the liver in response to a systemic inflammation) is regarded to be a powerful predictor for future CVD. (117-119)

Other important issues to consider for a reliable blood lipids measurement:

There is some evidence supporting seasonal variations of selected biomarkers of CVD including lipid profiles. (120-124) Kelly in his review of the relevant literature has concluded that irrespective of the age, sex, ethnicity and baseline lipid levels in the studied subjects a robust winter/summer variation exists with highest total cholesterol and LDL-C levels in winter. (120) Nazir et al. (124) have reported a significant reduction in TC, HDL-C, LDL-C, and apoprotein A-I during summer months while Ockene et al. (123) described such a variations in TC and HDL-C levels during summer in both sexes and reduction of LDL-C only in women. The rationale for such a variation needs to be studied in the future but the outcome can provoke major biases in the interpretation of the findings from epidemiological research implemented in dissimilar seasons or in the meta-analysis of the data from divergent studies to estimate an overall mean of lipids or prevalence rate of hyperlipidaemia within the targeted population.

There is also some debate in the literature regarding the effect of other factors, such as subject's posture or use of tourniquet on the lipoproteins level but validity of these hypotheses needs to be evaluated rigorously in the future. (125-127)

2.4.5 Elevated blood glucose

Despite our progress in the understanding of mechanisms and physiology of glucose homeostasis from the time diabetes mellitus was first described in 1552 BC, (128) it is still one of the major health concerns we are facing in the 21st century. Since its discovery in the 1920s, insulin was viewed as the unique hormonal regulator of glucose level in the circulation and so insulin deficiency was regarded as the centrepiece of hypotheses to describe aetiology of this mono-hormonal disorder. However with recognition of other influential glucoregulatory hormones our knowledge about diabetes and its contributing factors has expanded in recent years so that we consider it as a multi-hormonal disease.

Wild et al. (129) have argued that diabetes epidemic will continue to expand during the forthcoming decades due to increasing prevalence of obesity especially among urban population of the world. Most common type II diabetes imposed 98 billion dollar to the US economy in 1992 and it accounts for about 10% of the UK national health budget. (130) Additionally, it was indicated that impairment in glucose metabolism is associated with increased CVD. Levitzky et al. (131) for instance have indicated that CVD risk in women may be elevated at a lower glucose level compared to men. Faeh et al. (132) also have shown relationship between impaired glucose regulation and both major CVD risk factors and carotid/femoral intima-thickness. Proper measurement of glucose tolerance and determination of the epidemic's scale in several regions of the world therefore is pivotal in the CVD prevention programmes.

Since type II diabetes and its complications may start several years before the clinical diagnosis and thus many diabetics may remain undiagnosed, fasting (at least 8 hours overnight) plasma glucose (FPG) level can be applicable for screening purposes in the epidemiological studies. (131)

To have a reliable measure of blood glucose level major considerations should be taken into account. Glycolysis decreases glucose concentrations in the drawn whole

blood sample in vitro with time which could be inhibited by use of reagents such as sodium fluoride. Glycolysis rate in the first hour of sample collection in tubes with or without sodium fluoride is almost identical. So its use is unnecessary if glucose level is planned to be measured within the first hour after sampling otherwise, use of sodium fluoride can preserve glucose concentration in a stable level for up to three days.

It is possible to measure glucose level in whole blood, serum or plasma but plasma glucose level is recommended for diagnostic purposes. The molality of glucose in plasma is about similar with whole blood but almost 5% lower than the serum. (131, 133)

Another test to identify diabetics is oral glucose tolerance test (OGTT) which is performed 2 hours after a 75 gram oral glucose load in subjects who should fast before test for at least 14 hours. (76) There are controversies about use of this test as a diagnostic procedure. While International Diabetes Federation (IDF) and World Health Organisation (WHO) suggests its use, (131, 134) American Diabetes Association (ADA) (131) and Joint British Societies' guidelines (135) does not recommend its routine use in the general population to diagnose either type I or type II diabetes. Even so both ADA and WHO agree with the use of OGTT as a diagnostic tool for gestational diabetes mellitus (GDM), neither of them recommend 3-5 hours glucose tolerance test as a routine procedure. (131) The rationale behind OGTT not to be recommended by ADA is having of an almost identical sensitivity with FPG and existing of questions surrounding its repeatability, feasibility and cost. (136)

The glycated haemoglobin (as HbA1c) measurement to distinguish chronic glycaemia has been utilised for over two decades but there are major concerns about its sensitivity to diagnose diabetes. (137, 138) International Federation of Clinical Chemistry and Laboratory Medicine (IFCC) in an effort to standardise HbA1c measurement have developed a new method (measure of ultra-pure synthetic fragment of glycated haemoglobin rather than a mixture of glycated haemoglobins) and suggested that the results be provided in correct units (mmol/l) rather than a percent of haemoglobins with attached glucose. (138, 139) But despite advent of these methodological

recommendations more attempts still are needed to be done for its worldwide standard application as a screening or diagnostic test for diabetes.

Other important issues to consider for a reliable blood glucose measurement:

There is evidence of circadian variation of blood glucose level (140-143) and its implications for the diagnosis of abnormalities in glucose metabolism. But contributory factors affecting this variation are still poorly understood and need to be investigated in future studies. Therefore drawing of blood samples from all subjects in almost identical time of the day is the only practical way of control for this potential confounding factor.

2.4.6 Adiposity

Obesity is a well known risk factor for a number of CVD related complications including hypertension, diabetes and atherosclerotic disorders. (144) Several methods have been invented to assess adiposity but there are discussions about reliability of each method. Body Mass Index (BMI), Waist Circumference (WC) and Waist to Hip Ratio (WHR) are amongst the widely used markers of obesity in recent years. There are some debates about reliability of these markers in reflecting the precise magnitude of pathologic complications caused by obesity. BMI was suggested to be a useful indicator of overall adiposity however; pattern of body fat deposition was also indicated to be influential in the onset of differential CVD disorders. (145) With the same token although WC is easily obtainable but it was suggested to be an imprecise measure of abdominal adiposity since it reflects both the subcutaneous adipose tissue (SAT) and visceral adipose tissue (VAT) compartments. (144) This is while different fat depots have varying potential pathogenic effect for instance increase of VAT creates greater risk than increase of SAT. (146) As a disadvantage to this marker assessment of VAT requires imaging with radiographic techniques such as computed tomography (CT) or magnetic resonance imaging (MRI) which are potentially expensive, even so they have been used in several studies. (144, 145, 147-151) Findings of these and other similar studies are not convergent with regard to the sensitivity of the sophisticated techniques in predicting CVD risk in comparison to the simpler traditional techniques.

It was recommended in the study by Lee et al. (149) that WHR is not a reliable predictor of insulin sensitivity in either men or women and instead abdominal fat mass

which can be determined by dual energy X-ray absorptiometry scans (DXA) was introduced as the best sex independent predictor of insulin sensitivity index.

Notwithstanding, Sierra-Johnson et al. (150) have shown that WC has almost identical predictive information with DXA in men. This is while Onat et al. (151) have introduced WC as the best surrogate marker of VAT and its related CVD across a wide age range among the other applied measures such as computed tomography (CT) and abdominal sagittal diameter. Application of WC as a valid marker of VAT and consequent complications also was approved by Edwards et al. (152) Simpson et al. (153) have compared sensitivity of different adiposity measures (WHR, WC, BMI, fat mass and percentage of fat estimated by bioelectric impedance analysis) to predict all cause mortality associated with obesity. They have concluded that WHR may be used to predict the outcome in both sexes but WC only in men. They also have suggested that the use of bioelectric impedance analysis to estimate body fat mass and percentage of body fat will not add to the information provided by the traditional measures. Findings from the study by Menke et al. (154) have revealed that WC maintains strongest association with CVD risk factors than other measures of adiposity such as BMI, total body fat, body fat percentage and skinfold thickness. Same recommendation was given by Stamatelopoulos et al. (155) in relation to application of WC as best marker to predict atherosclerosis in young and middle aged healthy adults.

Chen et al. (156) have recommended that WHR is more useful than BMI or WC in the identification of subjects predicted to be at greater risk of CVD. The study by Dalton et al. (157) have also shown that WHR is the most useful measure of obesity (comparing to BMI and WC) and thus the identification tool of those who are in added risk of CVD.

Supine sagittal abdominal diameter (SAD) which is anteroposterior diameter of the abdomen or simply abdominal height in centimetre has been described as a potential marker of VAT. (158-162) Ohrvall et al (159) have suggested that SAD is a stronger predictor of CVD risk than other routine anthropometric variables like WC, WHR and BMI. Inter and intra-observer precision of SAD by anthropometry to predict VAT in comparison to WC, WHR and SAD computed by CT was discussed in the study by Zamboni et al. (158) This study confirmed precision of SAD by anthropometry and its

usefulness to predict VAT. Iribarren et al. (163) have used standing SAD to predict coronary heart disease (CHD) in their cohort study. They have concluded that standing SAD is a strong predictor of CHD independent of BMI. Despite these recommendations resulting from successful application of supine or standing SAD to predict CVD and its related disorders Mukuddem-Petersen et al. (164) have indicated that use of supine SAD has no advantages over simpler and commonly used anthropometric measures such as WC, WHR or BMI in elderly people.

In summary SAD might be worth studying in future clinical and epidemiological studies on VAT and CVD as an important assessment tool but obviously standardisation of its measurement should also be considered in the anthropometric measurement guidelines in order to base our judgements on reliable and sound data. Currently from a public health perspective it may be advisable to use the simplest, practical and precise anthropometric measure in population based studies to predict prospective pattern of CVD.

2.4.7 Unhealthy dietary habits

Unhealthy dietary pattern which was some times referred to Western dietary pattern in the literature is characterised by high intakes of refined grains, processed meat, fried foods and red meat. (165, 166) The association between having an unhealthy diet and a cluster of CVD related disorders is well documented. (167-170) Accurate estimation of habitual dietary intake for specific food groups and nutrients however, is a major concern in epidemiological studies. (171) The underlying objective of dietary assessment, whether for an individual or for a group is to determine dietary patterns or quantify nutrient intake. Dietary assessment methodology is therefore a crucial constituent of studies that are being aimed to identify the relationships between diet, health and illnesses. Information about diet may be collected by self report or by report from relatives and family members (especially in children and elderly people). In this case food frequency questionnaires (FFQ) or interviews (retrospective method) and food records (prospective method) are used. (172) Another option is to apply recovery biomarkers such as doubly-labelled water which is used to calculate almost accurately the dietary total energy intake. Currently reliable recovery biomarkers (urinary nitrogen

as a marker of protein intake and urinary potassium as a marker of dietary potassium intake) are only available for a few dietary factors and their utilisation in practice is very expensive. (173)

Each of these methods has its own merits, associated errors and constraints for use in different studies. Thus in most epidemiological studies use of self-report techniques will be the best, although imperfect available method to obtain dietary data. This technique however, reflects the amounts of energy and nutrients found in food and not necessarily the amounts available for the physiologic metabolism. (172) Therefore it is only applicable to measure average use of foods during a defined time period. Variability of subjects' habitual intake levels on the other hand is a reality and so dietary behaviour can not be measured without errors. Consequently the random measurement errors may decrease the statistical power of studies. (171) The precision of the dietary assessment technique have produced great concern in recent years and the "flattened-slope phenomenon" in which subjects with higher levels of food intake tend to underreport and those with lower food consumption tend to over report their dietary intake is very common in population based studies. (174, 175) Findings from application of FFQ in comparison to the recovery biomarkers have elucidated significant differences. (176, 177) Therefore to have reliable data about dietary behaviours it is very important to consider reliability and validity of various available FFQs according to the particular research needs and select an appropriate instrument that has been validated in the target population whenever possible. Even with application of such a questionnaire accuracy of dietary data will depend on the quality of instructions to the respondents, their amount of learning and readiness to answer the questions precisely.

2.4.8 Use of alcoholic drinks

Some evidence from observational studies implicated that moderate alcohol consumption which is defined as one standard drink per day (14 g of alcohol) have beneficial effect to reduce CVD through increasing of HDL-C and decreasing of LDL-C (170, 178-179). But what is not approved with certainty is whether the pattern of consumption has a role beyond the amount of consumed alcohol alone. Tolstrup (181)

in their recent article have discussed for instance that drinking frequency probably is more strongly associated with abdominal obesity than the amount of alcohol intake.

Mukamal et al. (182) in their study on roles of drinking pattern and type of consumed alcohol in occurrence of coronary heart disease among men have indicated that consumption of alcohol at least three to four days per week was inversely associated with the risk of myocardial infarction and neither the type nor the proportion of consumed beverage with meals substantially altered this association. Baglietto et al. (183) have shown that type of alcoholic beverage is important in all cause mortality and wine drinkers have a lower death risk comparing to beer drinkers or spirits consumers. They also have argued that benefits from phenolic acids and polyphenols which generally exist in vegetables and fruits probably be correct for wine and thus some of the protective effect of wine consumption at low doses may stem from fruit ingredient of wine rather than from alcohol per se. This is while Djoussé et al. (184) have demonstrated that alcohol consumption is associated with a lower prevalence of metabolic syndrome irrespective of the type of alcoholic beverage taken. In the study of Mukamal et al. (185) on alcohol consumption and risk of coronary heart disease (CHD) in older adults it was concluded that intake of 14 or more drinks per week irrespective of the beverage type is associated with the lowest risk of CHD. However Mukamal et al. (186) in another article have questioned the absolute benefit of moderate alcohol drinking in populations with healthy lifestyle. They have recommended that even with moderate consumption of alcoholic drinks there are potential health risks such as breast cancer in women and acceleration of cirrhosis in patients with hepatitis C and thus both possible benefits and risks should be considered when discussing alcohol intake. Furthermore in studies to investigate effects of moderate drinking on CVD, they have argued that control of other confounders can be difficult because of CVD multi-factorial nature (187) and also small effect size of moderate alcohol consumption relative to other CVD risk factors. They also have highlighted synergistic effect of combinations of CVD risk factors and difficulties of assessing all such combinations for effect modification. With such an ethical dilemma for the public health communities and in the absence of randomised controlled trials to study precise effect of moderate alcohol consumption

they have suggested that public health guidelines should not recommend initiation of alcohol drinking for health reasons. Consistent with this suggestion in another study Mukamal et al. (188) have illustrated that moderate alcohol drinking had not proven to prevent CVD and hence argued that the observational studies may be susceptible to uncontrolled confounding.

Furthermore there are important concerns regarding the use of current alcohol measurement methods. For instance Koppes et al. (189) have argued validity of the quantity-frequency questionnaire (QFQ) versus the dietary history interview (DHI) in their study and concluded that serious questions may arise in relation to the validity and precision of alcohol consumption measurements based on the QFQ alone. Thus they have suggested that with incorporating questions on the type of consumed beverage and also drinking patterns from DHI questionnaire accuracy of QFQ questionnaire may be improved. In another study on the application of alcohol measurement methodology in epidemiological research (190) it was discussed that use of different self-report alcohol measurement methods may result in widely different alcohol prevalence rates. It was also suggested in this study that self-report methods to measure alcohol consumption where there is no particular sensitivity to alcohol use can provide reliable results but when there are cultural or religious concerns this may lead to under-reporting. Based on the findings of their study Wurst et al. (191) suggested that use of a complementary biological marker such as ethyl glucuronide (EtG) which is a direct metabolite of ethanol and can be detected in various body fluids, tissues and hair may lead to major improvement in the accuracy of alcohol consumption self-reports. Wurst et al. (192) in another study on a population-based sample of Swedish pregnant women and based on measurement of direct ethanol metabolites in urine and hair samples indicated that only about 14% of those who were highly suspicious for heavy alcohol drinking (according to their hair sample analysis) admitted to have ongoing alcohol consumption.

Referring to the debates surrounding effect of moderate alcohol consumption on CVD and methodological issues hampering interpretation of the studies' results, further research based on valid and precise measures of alcohol intake and its pattern need to be conducted to clarify the role alcohol may have on CVD risk.

2.4.9 Medical history

In large population based CVD risk factors studies information about pre-existing CVD conditions and CVD risk factors is generally gathered by self-report questionnaires. While this method of data gathering is relatively inexpensive compared to physical examination and biochemical measurements, its reliability to collect valid data is often disputed as it may provoke systematic errors. Among many possible prominent factors on the accuracy of self-reported data participants' knowledge, their understanding of the relevant information, ability to recall events and their willingness to comply with questioner are pivotal. (193) Thus the rate of biased reporting can vary from one study to another. Molenaar et al. (194) have recommended including biometrical measurements in studies on the prevalence of hypertension and diabetes to ensure the validity of data.

Agreement between self-report data and medical record on the other hand for diabetes, hypertension, myocardial infarction and stroke was reported substantial by Okura Y et al. (195) but trivial for heart failure. Glinborg et al. (196) have argued that self-report is reliable for recent use of cardiovascular and anti-diabetic drugs. St Sauver et al. (197) pointed out to the inaccuracy of data about CVD conditions and CVD risk factors which are collected through self-report. By the same token Klungel et al. (198) have recommended using of information from other resources e.g. medical records as a complementary constituent of data in the population-based studies on CVD and its risk factors. Johansson et al. (199) have raised the issue of gender differences in accuracy of CVD risk factor self-reporting and also have pointed out to the differences they found in the accuracy of self-reporting for the different risk factors. All these findings support the view that adding biomedical data from other sources to the information derived from self-reports does markedly enhance the accuracy of data about medical history in the population based CVD studies. (194) But since accuracy of self-reporting differs between subgroups of population and from one risk factor to another the magnitude of the added precision will depend on the condition of interest and characteristics of the population under investigation. Therefore when self-reporting is the sole source of

information systemic errors may occur and to prevent it application of multiple data gathering techniques should be contemplated.

2.4.10 Family history

The association between family history of CVD and the presence of conventional CVD risk factors is well documented. (200-207) Wright et al. (200) have reported greater diastolic blood pressure reactivity and poorer systolic and diastolic blood pressure recovery from the stressors in individuals with family history of cardiovascular disease independent of baseline cardiovascular activity, body mass index, waist to hip ratio and smoking status. Carr et al. (201) have indicated that family history of type 2 diabetes increases the risk of CVD in women with gestational diabetes mellitus.

Juonala et al. (202) have illustrated the increased arterial vulnerability to metabolic risk factors among young adults with family history of coronary heart disease. Study conducted by Ford et al. (203) have not shown any association between family history of diabetes and C-reactive protein concentration in an representative population of the United States after adjusting for age, gender, ethnicity, education etc. Glowinska et al. (204) in their study on children with obesity, hypertension and diabetes have concluded that they often originate from families with CVD history. Leander et al. (205) have demonstrated that family history of coronary heart disease is not only a strong risk factor for myocardial infarction in both sexes but they also referred to its synergistic effect with other CVD risk factors. Thus Williams et al. (206) have recommended CVD family history collection as a validated and inexpensive tool for identifying high risk people in the population-based preventive programmes and research. Based on this background a rapidly growing field in cardiovascular genetic medicine is emerged to identify and understand cardiovascular conditions resulting from genetic mechanisms that are inherited. (207) But even with the accelerating pace of progress still family history merits further investigation as a public health tool which might save millions of lives and improve quality of life for many more.

2.4.11 Socio-economic factors

CVD and its related risk factors show a clear socio-economic (SES) gradient and highest prevalence of several CVD risk factors has been indicated to be found in those groups of population which have low socio-economic status (SES). (208-212) Different hypothesis have been formulated to explain this variation but the causal pathway itself requires further investigation to determine the contribution of SES determinants in shaping health status. This ambiguity in theoretical backbone of the findings should not only lead us to ignore SES as an independent co-factor in population based studies on the prevalence of CVD but it gives rise to concern that the gap between high and low SES sections of population should be filled. Alder et al. (213, 214) suggested that SES may affect health status through three pathways: health care, environmental exposure, and health behaviour. In order to work out effective strategies to combat CVD it is very important to determine which groups of population are in added risk of CVD and to what extent the higher risk is related to the values, attitudes and motivations and to what degree it is linked to lower standards of health care in the deprived groups of a population.

Socio-economic status generally is included in epidemiologic studies as a background variable but difficulties of collecting sound data in different communities and also interpretation of available data may restrict reliability of the study findings. (215) There are some discussions about applicability of different SES indicators in optimal prediction of health outcomes. (216, 217) Daly et al. (217) have argued in a longitudinal study that economic indicators of SES can be applicable as effectively as other SES conventional indicators like education and occupation to predict probability of mortality. Such a conclusion is consistent with the findings of the study conducted by Metcalf et al. (218) They have suggested according to their study results that household income is more strongly associated with the cardiovascular disease and diabetes risk factors than the individual's occupation or level of education per se. In another study by Metcalf et al. (219) it has been shown that raised blood pressure was associated with level of education and prevalence of diabetes mellitus with income. Bringing in mind all these complexities there is also some evidence (220, 221) which posits that adding ethnic

classification to the equation of SES may further hinder interpretation of findings in population based studies. Acheson (222) and Marmot (223) for instance have raised the issue of socio-economic differences between ethnic minorities and White population in the UK. In the Acheson's report (222) for instance, while just under a third of White households were indicated to live in poverty it was suggested that a third of Chinese, two-fifths of African Caribbean and Indian households and four-fifths of Pakistani and Bangladeshi households to have less than half of the average households' income. Referring to the findings of this and other similar studies Marmot (223) have suggested that more attention should be on setting targets and policies for reduction of health inequalities rather than repeatedly emphasizing the magnitude of health inequalities. Therefore, irrespective of practical difficulties which may occur in determining SES of a specified population group and regarding the overall role of SES in the epidemiology of CVD all initiatives should be targeted on understanding the socio-economic pattern of CVD and thus on reducing inequities between advantaged and disadvantaged groups in all countries.

2.4.12 Diversity in cardiovascular health among ethnic minorities:

examples of new ideas in the context of possible contributing CVD risk factors

In addition to the conventional CVD risk factors major efforts have been made in recent years to study possible effect of genetic or mixtures of environmental factors in the observed diverse CVD risk profiles among ethnic minorities. Therefore, several hypotheses developed to explain the reported variations in cardiovascular health among ethnic populations. But the ongoing debates to justify such differences and lack of a widespread consensus among the researchers represent the ambiguities that need to be clarified.

Some researchers suggested that genetically mediated anatomical differences are key factors in the reported variations of CVD profile among ethnic groups. Sniderman et al. (224) have suggested that the smaller superficial subcutaneous adipose tissue compartment might be influential in south Asians to develop the metabolic complications of upper body obesity at lower overall masses of adipose tissue compared

to the European White population. Natori et al. (225) have referred in their study to lower values of left ventricle (LV) mass and volumes among Asian-Americans compared to general White, African-Americans and Hispanics after adjustment for body surface area. They have discussed that lower values of LV mass and volumes can be regarded as a subclinical cardiovascular risk factor which may predict progression of a symptomatic CVD in the later stages of life. Kronmal et al. (226) have suggested that coronary artery calcium (CAC) progression as a predictor for CVD is more prevalent in White American than the Blacks, Hispanics and Chinese. In this study low creatinine was associated with higher risk of incident CAC. Creatinine is a breakdown product of creatine phosphate with an important energy store role in skeletal muscle. It is usually produced at a fairly constant rate by the body and filtered mainly by the kidney. If the filtering of the kidney is deficient, the blood levels rise. (227)

Markus et al. (228) have discussed possible influence of genetic factors in the development of stroke and indicated that the Black patients with stroke were significantly younger and had higher prevalence of hypertension, diabetes and obesity. They have highlighted the major differences in the distribution of stroke subtypes between Black and White patients. Based on the findings they have concluded that the stroke resulting from small vessel disease was markedly prevalent in Black patients whereas large vessel disease stroke was more common amongst White population. They have suggested that these differences can not be fully explained by differences in the conventional CVD risk factors.

Lear et al. (229) in their study to explore association between visceral adipose tissue (VAT) and carotid atherosclerosis have suggested that influence of obesity (defined by body mass index of $>30 \text{ kg/m}^2$) on CVD might be mediated through VAT. They have suggested that increase of VAT reduces insulin sensitivity and supplies free fatty acids into the hepatic circulation and thus stimulates the release of apolipoprotein B (the primary component of low density lipoproteins that can cause atherosclerosis). (230-232) Lear et al. (229) have measured in their study the extent of coronary calcification and carotid artery intima-media thickness (IMT) using ultrasound scans. They also have used a computerised tomography scanner (CT) to measure VAT and subcutaneous

abdominal adipose tissue (SAT). Thus they have concluded that having a low VAT but high waist circumference may not be an excess risk for atherosclerosis. Accordingly they have suggested that while VAT represents only 10% of adipose tissue in women but accounts for 20% in men at a given age, greater amount of SAT in younger women may also have a protective effect. They also have discussed that with age VAT of women tends to increase and reach to the levels of men. Through highlighting the relation between VAT and growth factors that may affect artery wall thickening, they also have suggested that VAT may have a greater role in IMT than the development of atherosclerotic plaque. According to the findings of this study the association between VAT and IMT is independent of waist circumference and waist-to-hip ratio. Release of a number of pro-inflammatory cytokines which stem from adipose tissue in the absence of acute inflammation was also suggested to lead to CVD in the literature. (233, 234) All these findings support the idea that with increased VAT even regardless of BMI, probability of developing CVD will increase. Moreover findings from a number of studies have verified that even with a BMI level in the normal range an increased waist circumference or waist-to-hip ratio may cause CVD. (235, 236) According to the findings of these studies neither waist circumference nor waist to hip ratio can reflect the total amount of CVD risks in a person or community. Therefore, variations in susceptibility of different ethnic groups to develop CVD must be scrutinised further not only by focusing on their life style but also more precisely by investigating physio-anatomical characteristics of divergent ethnic groups. Thus, even widely used cut off points for clinical and para-clinical indices such as BMI, waist circumference, waist to hip ratio, blood pressure levels and lipid profiles need to be validated for ethnic minorities as recommended by Razak et al. (237) and Stein et al. (238) Otherwise detection and reporting bias will affect our conclusions and thus policy making will be encumbered to provide equal access to health and health care for ethnic groups.

Genetically mediated variations in the blood biochemical factors also were suggested to explain ethnic diversities in CVD risk profile. Reynolds et al. (239) have raised in their study the issue of substantial lower cortisol concentrations in South Asians compared to Europeans. A positive association was found in this study between morning

cortisol levels and presence of cardiovascular risk factors in both South Asians and Europeans. According to the findings of this research, among South Asian subgroups, Bangladeshis have highest cortisol concentrations.

Jerrard-Dunne et al. (240) have discussed ethnic differences in markers of thrombophilia and suggested that the Black Africans have significantly lower protein S (a vitamin K-dependent plasma glycoprotein which is synthesised in the liver and has a major role in the anti coagulation pathway) (241), protein C (a vitamin K-dependent enzyme with a major physiological anticoagulant effect) (242) and anti-thrombin III (a glycoprotein which is produced by the liver and can inactivate several enzymes of the coagulation system) (243) compared to indigenous White population. They have concluded that these variations may explain the excess stroke risk in Black Africans.

Kanaya et al. (244) have indicated racial differences of serum adiponectin (a bioactive peptide which is secreted by adipose tissue and can influence inflammation, coagulation, and endothelial function as well as glucose and lipid metabolism) in Black and White Americans. Adiponectin levels was shown to be positively correlated with lipoprotein lipase activity and as an indication of lipase genes variations among the races, Kanaya et al. (244) have concluded that Black Americans have higher lipoprotein lipase activity and reduced hepatic lipase activity compared to Whites. They also have suggested that while this variation should contribute to the favorable plasma lipoprotein profile and lower level of visceral fat but on the other hand possible role of the high-molecular-weight form of adiponectin in lipase activity should not be disregarded. Thus they have discussed that Black Americans may have lower proportions of the high molecular-weight adiponectin relative to the total circulating adiponectin concentrations. As a consequence, they have argued that regulation of lipoprotein lipase activity slows down among Black Americans which in turn decreases favorable lipoprotein profile and consequently increases risk of coronary heart disease. Concurrent with these results Lu et al. (245) also have indicated significant variations of adiponectin levels between African-Americans and Caucasians. African-Americans in this study had lower levels of the adiponectin which is similar to the findings from another study conducted by Hanley et al. (246) to compare this ethnic group with Hispanics.

Race/ethnicity effect on the interaction between serum leptin (an adipose tissue originated hormone) concentration and myocardial infarction was also studied recently. (247) Moreover serum level of C-reactive protein (CRP) (a marker of inflammation which is produced by the liver and also by the smooth muscle cells of coronary arteries in response to an inflammatory episode) was indicated to be influenced by race and ethnicity and therefore suggested to be applicable in predicting future CVD risk. (248, 249)

Differences in lipoprotein particle sizes have been introduced as another hypothesis to justify racial variations in CAC which is not convergent with the results of the study carried out by Aiyer et al. (250)

Homocysteine is a sulphurated amino acid and a natural by-product of a chemical reaction in blood which can prohibit production of collagen and elastin, two main structural proteins in arteries. (251) It is suggested in the literature that deficiencies of folic acid (B₉), pyridoxine (B₆), cyanocobalamin (B₁₂) or a pre-existing atherosclerosis and diabetes can lead to high homocysteine levels which is believed to be a risk factor for CVD. (252-254) Albert et al. (255) on their study on women without a history of CVD have indicated that homocysteine is lower in Asian women comparing to Whites, Hispanic and Black American women. Even so Cappuccio et al. (256) reported that Indians have significantly higher levels of homocysteine than Whites, West Africans and Caribbeans residing in UK. These heterogeneous results are indicating insufficiency of studies to investigate race/ethnic variation of homocysteine level and other blood biochemical markers. Hence, more studies needed to be done to prove the association.

Possible effect of some behavioural and environmental factors like using toilet in squatting posture, vitamin D deficiency, infection and the combined impact of smoking and tobacco chewing among South Asians to have higher risk of stroke were suggested by Bhopal et al. (257).

Other aspect of diversity in cardiovascular health of ethnic groups can be explained by implicit race/ethnicity bias (unconscious) in unequal accessibility of preventive health measures or proper treatment of CVD patients belonging to a certain ethnic group. Such a bias in favour of White American patients to receive thrombolysis was reported by

Green et al. (258) and Jha et al. (259) Similar failure also was seen in the equal treatment of Black Caribbean patients in the UK to reduce blood pressure, total cholesterol and haemoglobin A1c (HbA1c is a glycosylated haemoglobin molecule) level. (260) A part of this bias may emanate from race/ethnic CVD awareness gap (261) or lack of thorough knowledge of the health care providers about existing diversities in the CVD predisposing factors among ethnic groups. This deficient knowledge itself was represented well in the unequal number of cardiovascular studies on original White American or European population in comparison to ethnic populations settled in these continents from decades ago. (262)

To summarise, all above discussed hypotheses are based on ethnic variations in:

- Superficial subcutaneous adipose tissue compartment (221)
- Values of left ventricle mass and volumes (225)
- Coronary artery calcium (CAC) progression (226)
- Cortisol concentrations (239)
- Protein S, protein C and anti-thrombin III levels (240)
- Serum adiponectin levels (244, 245)
- Serum leptin levels (247)
- C-reactive protein levels (CRP) (248, 249)
- Homocysteine levels (255)
- Vitamin D levels (257)

Obviously more work need to be done on these and other possible hypotheses before their practical application in interventional initiatives. But whether the observed differences were provoked by unconscious bias, behavioural and environmental factors or due to real genetic differences among ethnic minorities, their presence indicates a failure to follow best practice standards both in our research and health care delivery systems.

2.5 Techniques to recruit hard-to-reach populations

Hard-to-reach population is a term used to describe those sub-groups of the population that are difficult to reach or involve in research or public health programmes due to their physical and geographical location (e.g. in mountains, forests or deserts) or

their social and economic situation. (263) An alternative term 'hidden population' sometimes used in the literature especially to refer to those who do not wish to be found or contacted (illegal drug users or migrants, homeless people etc). (264) Application of a single term to call these sub-sections of populations implies a homogeneity within the distinct groups which does not exist necessarily. (265) Hard-to-reach populations may also actively try to conceal their group identity (266) due to fear of confrontation with legal authorities (e.g. drug users) or simply because of social pressure they feel from other members of the broader community. Hard-to-reach populations may be characterised by a group of disadvantage attributes such as illiteracy or being uncooperative but this is not the case in all circumstances and for all hard-to-reach populations. In addition, even with distinguishing hard-to-reach populations by these underprivileged features we should try to avoid stigmatising of this terminology.

It is suggested that faith based communities and newly arrived residents are among the hard-to-reach populations. Over-consulted people also have been suggested to be generally reluctant to participate in research. People who feel are disconnected from the mainstream political process also were added to the list of hard-to-reach groups. (267) Migrants are also among world's most hard-to-reach people due to their clustering on the host communities, living in temporary camps, cultural separateness or simply because of difficulties an outsider may experience to access the social network of an special migrant group. (263)

The degree of compliance with a study by a certain hard-to-reach group depends on the characteristics of that group, recruitment method used and the subject of interest. A group may be hard-to-reach in some extents and locations and not in all circumstances. (267) Even when studies are explicitly designed to reach socially excluded groups researchers generally face with challenges in recruiting enough number of study participants in practice. (268) Cultural, economic and social factors or lack of a sampling frame can raise barriers to access a special subgroup of a population. Different sampling techniques were introduced so far to recruit hard-to-reach populations. Widely applied techniques, their advantages and disadvantages were summarised below using views of

the authors in the corresponding references. My overall judgement about the discussed techniques is provided in section 2.5.8.

2.5.1 Snowball sampling

Snowball sampling is a non-probability method used when the desired sample characteristic is rare or when the studied population is broader and more heterogeneous than that can be easily accessible through other more reliable sampling methods. (269)

It is not always possible to undertake a probability method of sampling when for example there is not a complete or easily accessible sampling frame which is common for certain groups of population including migrants. (270) In these circumstances it can be very difficult or expensive to recruit study subjects. In the snowball sampling method reliance is based on referrals from initial known subjects to recruit new additional subjects. This method is often used when population under investigation is hard-to-reach due to their special characteristics or sensitivity of the study subject. (271) The known cases may be contacted to acquire needed data. If these known cases mutually agree to participate in the study they will be asked to nominate and facilitate introductions to other people whom they know according to the interpersonal relations and connections between people. Accordingly the introduced nominee will be contacted and invited to participate in the study and if consent he or she is asked to introduce other people who fulfil the study inclusion criteria. (269, 271)

This strategy is regarded as a solution to the problems which generally arise when sampling concealed populations. (264) Basic assumption in the snowball sampling is that a link exists between the initial known subjects and others in the same target population. If this assumption is accurate it will allow a chain of acquaintance to be created originating from primary contacts. (264) Main value of the snowball sampling is its usefulness where some degree of trust is needed to initiate study subjects' recruiting process. Limited validity of data resulting from selection bias is the most important consideration for snowball sampling. Therefore findings from data gathered through snowball sampling were suggested not to be generalisable to the whole population. It is also discussed that in snowball sampling emphasis is on the inter-relationships which isolates those who are not connected to any social network and thus are under-

represented in the sample. The problem of selection bias is recommended to be solved relatively through selection of large sample and also by replication of results. (264)

2.5.2 Respondent-driven Sampling (RDS)

As Heckathorn et al. (272) stated main criticism about chain-referral or snowball sampling is bias toward recruiting more cooperative subjects and masking which is protecting close friends or relatives by not referring them when specially there is a strong privacy concern associated with the subject of the study. It is also suggested that those with extended personal networks to be over-sampled and isolated people to be excluded in the study.

Developed by Heckathorn (273) in 1997, RDS is a form of chain-referral sampling that was designed to eliminate above mentioned sources of bias that are not inherent in the method. In order to lengthen recruitment procedure three mechanisms were suggested to be employed in RDS. These are; use of recruitment incentives (payment for participation and also for recruiting peers), limiting the number of recruits permitted per participant and not violating participants' confidentiality by letting them decide whether to become known to researcher or not (respondents should be recruited by their peers rather than by researchers). (272) RDS combines snowball sampling with a mathematical model that weights the sample to compensate for the fact that the sample was collected non-randomly. (273) But still many open questions remain with RDS including bias which can emerge from variable recruitment success rate by different types of people in an individual study. (274)

2.5.3 Indigenous field worker sampling (IFWS)

In this sampling method instead of using formal trained interviewer, interviewers are selected from local community. Then they undergo special training relevant with objectives of the study including interview skills and fieldwork protocol. The selected people should have privileged access to the study target population. (275, 276) It is believed that use of this technique can reduce masking, volunteer bias and under-reporting of socially undesirable behaviours. (277, 278)

The indigenous fieldworkers track down individuals known to them within the target area and recruit them into the study. Interview takes place in the community setting

separate from the rest of research team. An incentive is given to participants and they are asked to introduce their peers to the interviewer. To insure wide coverage of the target population use of multiple sites and recruitment networks is recommended. Interviewers' safety and steady progress of recruitment process are main reported concerns. (275)

2.5.4 Facility-based sampling (FBS)

Facility-based sampling refers to recruiting members of target population from a variety of facilities including correctional and drug treatment centres, sexually transmitted diseases clinics or general health centres and hospitals in certain sub-urban areas. (279) Each of these facilities can be used to recruit individuals from hidden population but similar biases may occur due to under-sampling of those who are reluctant to seek and obtain services especially when their behaviours are stigmatised. Other limitation for this sampling method is that in many part of the world particularly in less developed countries dedicated services to high risk groups are not common and even where provided; equal access to them by deprived sub-groups of population is not guaranteed. (279)

2.5.5 Targeted sampling (TS)

Targeted or purposive sampling method has been developed to overcome the limitation of snowball sampling when we would like to include specific pre-defined subgroups of population in our sample. (279, 280) This sampling method generally includes an initial assessment aimed at identifying the various subgroups that might exist in the population of interest. The identified subgroups are then regarded as sampling strata which should have a pre-defined quota in the final sample. The magnitude of success in this sampling method depends mainly on thoroughness of the initial assessment and to some extent the time and resources available for its undertaking. (279) Application of this method can reach readily accessible subgroups very quickly (281) but on the other hand reaching isolated people will be very time consuming and therefore expensive.

2.5.6 Time-location (space) sampling (TLS)

Some members of hidden populations e.g. migrant workers tend to gather at certain types of location within the community and therefore time-location sampling is used to recruit these groups of hard-to-reach populations at locations where they may be found. (279, 282) Generally TLS begins with a formative phase of mapping different venues and establishments where individuals from hidden groups are known to congregate. The mapping generates a sampling frame of venues and time periods through which recruitment of individuals from a specific group of a hidden population will be possible. (283, 284) At later stage the sampling frame is divided into venue-day-time increments that form the unit of random sampling. (283) These steps are necessary to ensure inclusion of individuals with varying venue and time attendance patterns. (284)

It is suggested that bias due to masking and chain-referral selection of study participants is eliminated in TLS (282) however, unless a high percent of venues where members of hidden populations gather are identified and a very high percent of members from target population visit such locations, TLS also can suffer from potentially considerable bias. Isolated people for instance who do not visit such locations will be under-represented in the sample. (279)

2.5.7 Conventional cluster sampling (CCS)

Conventional cluster sampling can be applied in limited circumstances to recruit hard-to-reach population. Cluster sampling is reasonable when there is no list of people to be selected but a good list of locations where individuals from hard-to-reach group are gathered. Primary presumption for use of this sampling method is that the distribution of the variable of interest is similar between locations (clusters). (279, 285) Clusters then are randomly selected for data gathering and thus recruitment costs will be minimised since the number of locations from which recruitment take place reduces. Clusters can be perinatal clinics, drug treatment centres, restaurants or health centres. Other requirement to be met in using this method is the possibility of ready access to all individuals from the population of interest in the clusters; otherwise cluster sampling will be an infeasible option to reach hidden populations.

2.5.8 Recruitment of hard-to-reach populations: a holistic approach beyond techniques

To sum up and irrespective of potential advantages or limitations of the discussed techniques, their successful use depend mainly upon our knowledge about specific characteristics of a target subgroup within a larger population. Without having such essential information it is very difficult to clarify which method will work best to recruit different hard-to-reach populations in varying settings and circumstances. Moreover our current knowledge about the recruitment techniques is based on their application in a wide range of topics and mostly within socially, culturally or behaviourally homogenous population subgroups. People belonging to a specific ethnic minority may be classified socially and culturally in a wider spectrum and are not necessarily homogenous. Thus in line with attempts to expand the current boundaries of our knowledge about recruitment techniques and their applications in varying situations, we should also focus on possibly all contributing factors which may have an impact on participation rate within a defined ethnic minority group.

2.6 Interpersonal access to the data: issues and barriers

Studies on hidden populations raise a number of issues which are usually less important when doing research involving known populations. Hard-to-reach populations are generally floating populations and socially invisible thus gaining access to them poses major barriers for their recruitment. (286) Sensitivity of the variables under study also adds to the potential difficulties a researcher may face when working with hard-to-reach groups. Even after reaching and recruiting an individual from a hidden population actual or perceived threat from legal authorities when doing research on stigmatised or illegal behaviours can increase probability of concealing identity, a particular behaviour or characteristic.

People may not agree to cooperate in a study if they feel their anonymity may be violated by their participation. Even after consent to be a participant he/she may refrain from giving correct answer to the questions. In order to overcome these difficulties use of peer interviewers (an insider vs. an outsider) (287) and also being very careful and conservative when planning and asking questions on sensitive issues are recommended.



An insider can generally better understand para-verbal (the way people say the words) and nonverbal (body language) messages in addition to the language hard-to-reach people apply when talking about their status. Cultural differences in beliefs towards health and health related practices also can be more understandable for a peer interviewer than an outsider.

2.7 Evidence based research: dilemmas and debates

Evidence based research (EBR) in health and medicine is a methodological approach to make research proposals based on an intimate knowledge in order to maximise efficacy of the investments to answer research questions or investigate scientific hypotheses. Therefore the ultimate goal of EBR is to improve health care and policies. Ubiquity of error in health care settings and unjustifiable variations in practice are indications of challenges we are still facing in this field. (288)

EBR focuses attention on the consequences of unsystematic research planning as grounds for decision-making in public health. In the absence of a sound foundation, public health policies lack scientific credibility which is vital for their successful implementation. (289) Planning of an evidence based research involves identification, evaluation and application of scientific evidence which was produced based on previous works in the field. This process of reviewing and evaluating the scientific literature was called systematic review which aims at evaluating and interpreting all relevant evidence available to answer a particular question. (290)

Lack of this comprehensive approach to find and include all available evidence in research and consequently in decision making about health policies can delay important and useful developments in science and thus necessary revisions in health delivery systems. As an example more than 50000 babies in Europe have died due to sudden infant death syndrome (SIDS) from the 1950's into the 1990's following an advice given in a best-selling book to put babies to sleep on the prone position. (291) While even that time there was sufficient research evidence from scattered studies suggesting adverse effect of the recommended sleeping position on SIDS.

2.8 Systematic review and meta-analysis: prerequisite to evidence based research

Evaluation of scientific literature can range from narrative reviews which are very subjective and prone to major biases to highly formal syntheses of best available evidence. In a systematic review previous studies of interest are identified, assessed for quality and synthesised to investigate the consistency of an overall outcome measure. (290) Major difference of a systematic review with a narrative review is its transparency with regard to the identification, appraisal and synthesis steps.

With current increase in the number of conducted and published studies it is extremely crucial to make research steps very clear to the audiences. Otherwise two reviews on the same topic may come to divergent conclusions without any chance for readers to realise the perpetrating reason(s). In systematic reviews explicit and rigorous methods are employed to clarify the whole truth about a scientific phenomenon and not a part of truth which can be confusing and misleading. A reliable systematic review will be invaluable for us to keep up to date and realise boundaries of current knowledge. (292)

Statistical synthesis of pooled data from studies that have attempted to answer same questions is called meta-analysis. It is an analytical method to integrate different studies together and pool their results into a single common result. (293) Two basic models can be applied to integrate different studies in a meta-analysis: fixed effect model in which homogeneity of the studies are assumed and random-effects model which avoids the homogeneity assumption. (294) Mixed effect model is the combination of fixed and random effects model which is also applicable when dealing with subgroup analysis in a meta-analysis. (295)

A rational decision can not be made without having in depth information about possibly every aspect of health issues. Therefore systematic review and meta-analysis are considered to be the fundamental scientific activity in practising EBR. Development of the Campbell and Cochrane collaborations to prepare and maintain systematic reviews of research on health related issues reflects the surge of interest in systematic review and meta-analysis internationally. (296)

In this chapter it has been indicated that CVD is a global threat despite considerable development of our knowledge about its aetiology and prognostic implications. It is also discussed that a widespread diversity exists among different population groups regarding CVD and its contributing risk factors. Such a gap between migrant and general population in destination countries was the subject of attention in recent years. Complexity in measurement of CVD risk factors and lack of standard methods that can be applicable in socially and culturally divergent groups have created a list of unanswered questions that need to be scrutinised. Moreover difficulties in recruitment of migrants into population based CVD studies even added further discussion on this topic.

With such a background and to gain experience and learn lessons from other population-based studies on Iranians living abroad a systematic review has been conducted on the recruitment methods and health related themes of research. The ultimate goal of the systematic review was to aid planning and implementation of reliable, new population-based studies on Iranians overseas. The protocol and results of this systematic review is provided in the next chapter.

2.9 Summary

Our knowledge about determinants and consequences of cardiovascular diseases (CVD) have extensively improved in recent years but still CVD takes lives of more people than any other disease in several countries of the world. With recent accelerated pace of migration from developing world a sizeable number of ethnic groups were formed in the developed countries. Distinct divergences in CVD mortality and morbidity rates have been reported in the immigrant population of these countries. This disparity was attributed in the literature to genetic, differences in the associated risk factors and the variations in the socio-economic or environmental features. However; a considerable amount of uncertainty still remains to be resolved.

Migrants are among the world's most hard-to-reach people due to their clustering on the host communities, living in temporary camps, cultural separateness or simply because of difficulties an outsider may experience to access the social network of a special migrant group. Complexity in measurement of CVD risk factors and lack of standard methods that can be applicable in socially and culturally divergent groups have

created a list of unanswered questions that need to be scrutinised. To make health policies based on an intimate knowledge and to maximise efficacy of the investments to answer research questions, employment of evidence based research (EBR) approach in research is vital. In the absence of a sound foundation, public health policies lack scientific credibility which is crucial for their successful implementation.

To gain experience and learn lessons from other population-based studies on Iranians living abroad to aid planning and implementation of reliable, new population-based studies on Iranians overseas a systematic review has been conducted on the recruitment methods and health related themes of research. The protocol and results of this systematic review is provided in the next chapter.

Chapter three: A systematic review of the methods and themes of health-related research on the Iranian Diaspora *

3.1 Introduction

In the previous chapter global burden of cardiovascular disease and diversities in cardiovascular health among migrant populations were discussed. It was also indicated that migrants are among hard-to-reach population and thus researchers generally face with challenges in recruiting them into health studies. It was suggested that a growing number of Iranian migrants dispersed within the general population mostly in the European countries and North America. The research evidence on which to base health care planning and provision decisions for the Iranian Diaspora is, however, very limited. This chapter describes the protocol and results of a systematic review that was carried out on methods used in population-based health research on Iranians abroad in order to learn lessons to apply to future planned epidemiological researches.

3.2 Background

Researchers are, through studying ethnic groups as discrete communities, endeavouring to improve health status and reduce health inequalities, as mandated by health policies and equal opportunities legislation. They are however frequently encountering problems in the implementation stages, this is notably manifesting as a failure to identify and recruit the planned number of participants.

* Findings of this systematic review were published earlier as an article (see appendix one). (297) Professor Raj S. Bhopal, Professor Aziz Sheikh and Dr Farshid Namdaran had a major contribution in drafting of this article.

There are many potential explanations for this, including lack of knowledge about the sociocultural features of each individual ethnic group. A rigorous look at recruitment strategies and sociocultural attributes of potential participants is therefore extremely important in the planning phase of research on ethnic minority groups.

There is an enlarging Middle Eastern Diaspora and as stated in chapter one Iranians are one of the major subgroups. Iranian migrants are generally wealthy and educated comparing to the source population or to the population of other minorities e.g. Caribbean, Bangladeshi and Pakistani groups in destination countries. According to the statistics given by official resources at least 428,386 Iranians (36-45) migrated to the Australia, Austria, Canada, Denmark, Germany, Netherlands, Norway, Sweden, UK and United State during 1990-2005. However, the actual number of migrants having Iranian origins is likely to be more than official reports since these figures do not represent asylum seekers and illegal immigrants. Yet the number of population-based health studies on Iranians abroad is small. Iranians are dispersed within the general population in the destination countries and have no easily identifiable names or surnames, these factors possibly contributing to the dearth of such studies. Iran itself is a multi-ethnic and multi-cultural country and this background diversity is reflected in the language, lifestyle and living conditions of Iranian migrants overseas. Conducting population-based studies on this minority group is therefore challenging.

The lack of studies on Iranian migrant population is believed by some researchers to reflect a lack of willingness of Iranians to participate in research for reasons including fear of being identified, particularly among political migrants. (298, 299) There is however no reliable summary of the empirical literature to substantiate this assertion. Based on the recommended structure (PICO: Population, Intervention, Comparison and Outcome) explained by Glasziou et al. (290) the study question was framed in a systematic review to provide sound evidence about any possible reservation (phenomena) Iranian migrants (population) may have to participate (outcome) in health studies. The review aimed to gain experience and learn lessons about successful recruitment methods of Iranian migrants into population based health studies. Result of this systematic review can aid planning and implementation of reliable, new population-

based studies on Iranians overseas. The review focuses on sample size and recruitment strategies and also assesses the range of topics covered and hence both the range of themes already studied and those that remain unstudied. The main question of this review is how other researchers have reached and recruited Iranian migrants into population based health studies. Ultimately the review aims to help treat Iranian origin minorities equally in relation to research and access to health and health care. To the best of current knowledge, this systematic review is the first review of the recruitment methods in this population.

3.3 Methods

3.3.1 Types of studies

The protocol of this systematic review was planned based on the MOOSE (Meta Analysis of Observational Studies in Epidemiology) guidelines. (300) The MOOSE guidelines include a checklist summarising recommendations for reporting meta-analyses of observational studies. All population based quantitative studies, qualitative researches and social surveys on free-living Iranians (not those living in institutions) residing abroad (settled in a permanent base, so excluding students overseas) were eligible if they were:

- Published in English or Persian.
- Reported sample recruitment strategy, sample size and data collection technique.

Systematic reviews of observational studies usually exclude qualitative studies. Although qualitative studies may not contribute to synthesis of quantitative epidemiological studies, in view of the suggestion that the lack of studies on Iranian migrant population may reflect a lack of willingness of Iranians to participate in research for reasons including fear of being identified, particularly among political migrants, it was judged that qualitative studies on Iranians could be a rich source of understanding about their possible reluctance to participate in research and highlight methodological barriers to recruiting Iranians overseas into population-based studies. Thus such studies were included.

3.3.2 Types of data

Types of collected data included the following:

- Demographic characteristics of studied sample (age, sex, status of residency and current place of living)
- Sampling approaches in the eligible studies (sample size and recruitment strategy, sampling methods, sampling frame)
- Study features (researcher, study subject and type, data collection technique and study implementation year)

3.3.3 Types of outcome sought

Topics covered by studies.

- Number of studies on Iranians living abroad by country.
- Number of studies having good quality information on methods (sample size, sampling method, sampling frame and recruitment criteria of subjects).
- Type of recruitment strategies.
- Response rates.
- Main lessons from eligible studies that may help planning of future studies on Iranians abroad.

3.3.4 Search strategy

The free text and MeSH (Medical Subject Headings) indexing terms (Appendix two) were used to search the following databases that were considered to be most relevant in terms of this systematic review's objectives:

- AMED (Allied and Complementary Medicine) (1985 to April, 2006).
- CINAHL (Cumulative Index to Nursing & Allied Health Literature) (1982 to March week 5, 2006).
- EMBASE (1980 to week 13, 2006).
- Ovid MEDLINE(R):
 - (1950 to 1965).
 - (1966 to April 07, 2006).
 - In-Process & Other Non-Indexed Citations (April 06, 2006).
- CAB Abstracts (1973 to March 2006).

- Global Health (1973 to March 2006).
- Index to theses (A comprehensive listing of theses with abstracts accepted for higher degrees by universities in Great Britain and Ireland since 1716) (1716 to March 06, 2006).
- National Research Register (UK).
- International Bibliography of the Social Sciences 1951 to April week 01, 2006).

Other electronic resources such as web pages of ethnicity related organisations or official health organisations of countries known as having a fair number of Iranians and potentially pertinent Internet sites (Google) were searched for unpublished materials.

The review was limited to English and Persian language studies published between 1950 up to April week 01, 2006. The titles and abstracts of all retrieved records were checked to distinguish relevant articles. Articles were excluded on initial screening if the title and the abstract showed that they were not reporting population-based studies on Iranians. When a title or abstract could not be rejected with certainty, the full text of the article was acquired for further assessment. For those studies that were potentially relevant, full papers were secured. References of relevant articles were inspected. Studies were recognised through serendipitous discovery also included in this systematic review. Researchers (Dr. Sirous Momenzadeh, Dr. Freidoon Khavarpour, Professor Haakon Meyer) well known to do work on Iranian ethnic groups were contacted for references.

Reference manager software (version 10) was utilised and the duplicate entries were deleted. A data extraction sheet was used for summarising included studies (Appendix three). These studies were also assessed for their quality according to the internal and external validity criteria (Appendix four).

3.3.5 Data extraction

All relevant data in the articles were extracted into the data extraction form. A description of the problems encountered by the researcher(s) in recruiting the study sample or recommendations to increase participation rate were also derived.

3.3.6 Data presentation

Data were tabulated chronologically by country of study and presented in descriptive form. Response rate was calculated as percent of participants in the study in relation to those intended to participate by the researcher.

3.4 Results

QUOROM (Quality of Reporting of Meta-Analyses) statement (300, 301) which is renamed later as PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) (302, 303) was used to report results of this systematic review. 310 studies (including duplicates) were identified mainly from AMED (1 article), CINAHL (11 articles), EMBASE (83 articles), MEDLINE (1966 to 07 April 2006) (109 articles), CAB (1973 to March 2006) (35 articles), Global Health (1973 to March 2006) (29 articles) and International Bibliography of the Social Sciences (1951 to February week 01, 2006) (42 articles) (Figure 3.1).

Review of the titles of these studies identified 70 potentially pertinent articles. Review of the abstracts lead to 24 studies (298, 299, 304-325) which met the inclusion criteria. Full texts of these articles were obtained and 20 studies (298, 299, 304-321) met the initial criteria.

A further 56 candidate articles (326-381) were identified by reviewing the references of these 20 articles and 9 had potential for inclusion. (382-390) One study also resulted from serendipitous discovery of unpublished work presented in the Sixth International Conference on Preventive Cardiology at Foz do Iguaçu, Brazil in 21-25 May of 2005. Findings of this study published later in the European journal of cardiovascular prevention and rehabilitation 2006. (391) Thus 30 articles were fully assessed.

An internal report from the Institute for Social Anthropology in the University of Bergen, Norway (382) was not obtainable (the request was sent to the email address have been given on the institute website). In six other studies (383-388) Iranians were a part of study sample but they had been categorised in the group of "*immigrants from other countries*" and not analysed separately. One article (389) was on college students but since it was not clear from the full text whether these students were spending a length of time at their place of study or had grown up in the host country, it was excluded.

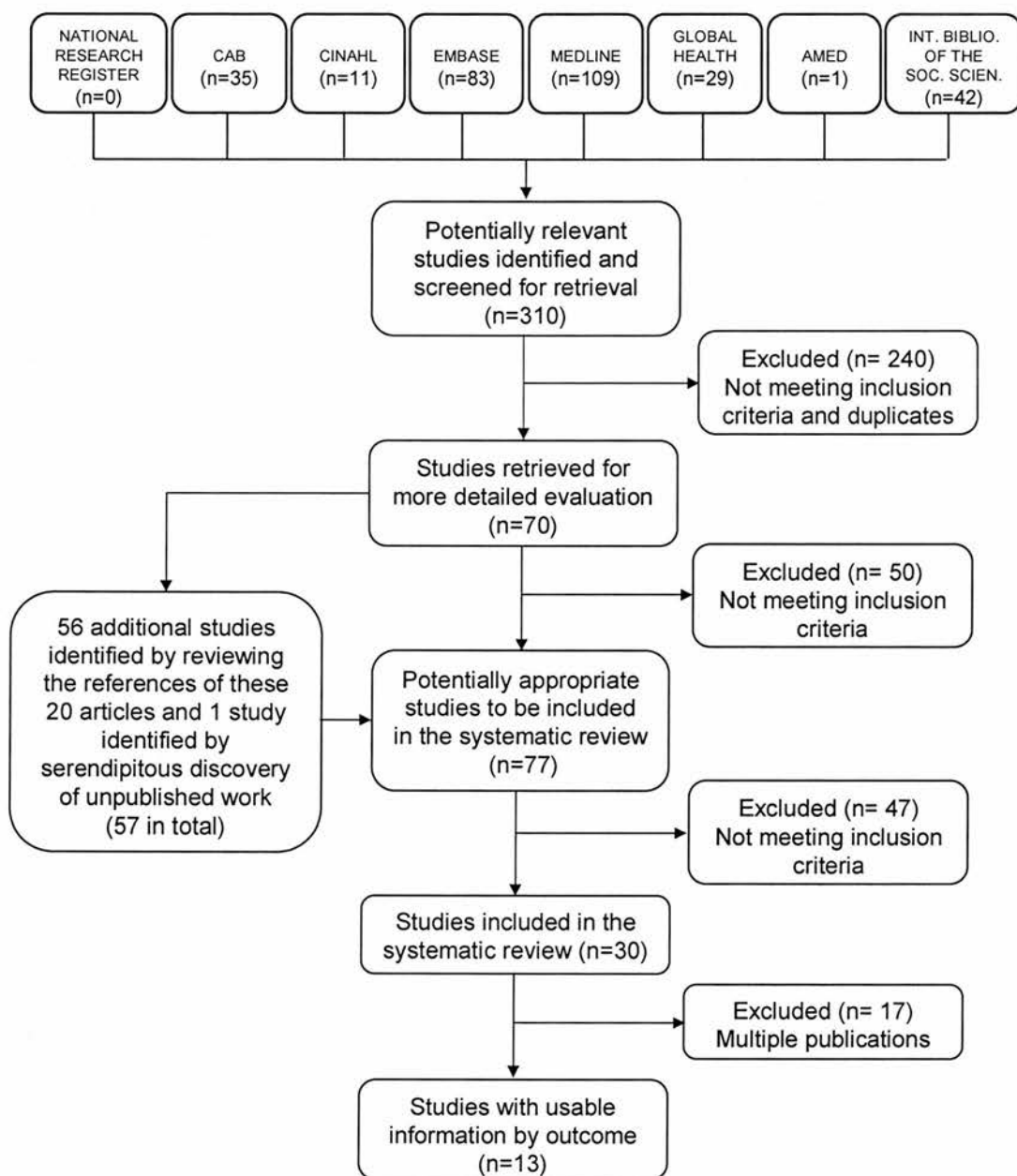


Figure 3.1 The PRISMA flow diagram: number and status of the identified articles in the systematic review of the methods and themes of health-related research on the Iranian Diaspora

Correspondence with other researchers did not add to the list of relevant studies. From 22 (17.3%) articles that met the inclusion criteria (298, 300, 304-321, 390, 391) seven (306-309, 311, 312, 314) were publications from the Immigrant Survey of Living Conditions in four minority groups of Sweden. Two studies from Australia, (305, 315) two from Netherlands (310, 317) and two from Norway (318, 391) were also publications based on data from same studies.

Since methodologies for sampling, recruiting and participation rate in several publications from same study are identical it was decided to include one sample study from each group of these publications. Thus 17 studies were excluded (Table 3.1) from the list of retrieved studies and only 13 studies were the focus of this review as shown in Table 3.2.

3.4.1 Studies reporting data

The topics included dental health, cardiovascular risk factors, sex roles, cultural identity and acculturation, healthy behaviour, mental health, vitamin deficiency and research methods.

Eight studies (298, 304, 305, 313, 316, 319, 320, 390) were implemented by authors with Iranian names. They took place in six countries: Australia with two (15.4%), Canada with one (7.7%), Netherlands with one (7.7%), Norway with one (7.7%), Sweden with two (15.4%) and United States with six (46.1%) studies. In the Canadian study methods for creating a list of Iranians through linking specific surnames and given names were described. Sample size among the other twelve studies was in the range of 10-413. Convenience sampling, (298, 299, 304) snowball sampling method, (305, 313, 319, 321) inclusive sampling (318) and random sampling method (307, 317, 320, 390) had been used. Participation rate in studies that used snowball sampling ranged from 19% with postal questionnaires and 99% with telephone interview. The participation rate in studies with convenience sampling method were 33.3-57% and in studies with random sampling methods in the range of 21.3-68.1%. This rate in studies where inclusive sampling was used was reported to be 38.8%. (318)

Table 3.1 Excluded studies by title and reason of exclusion in the systematic review of the methods and themes of health-related research on the Iranian Diaspora

Title of Study/author(s)/publication year/ reference	Reason for exclusion
Australia	
Mental health status of Iranian migrants in Sydney - Khavarpour F, Rissel C 1997 (315)	Paper published from a study already included
Netherlands	
Health and health care utilisation among asylum seekers and refugees in the Netherlands: design of a study - Gerritsen A et al. 2004 (310)	Paper published from a study already included
Norway	
Iranian immigrants and refugees in Norway - Kamalkhani Z 1999 (382)	Not obtainable
Cardiovascular risk factors among five major immigrant groups in Oslo, Norway - Glenday K et al. 2006 (391)	Paper published from a study already included
Sweden	
Impact of ethnicity, violence and acculturation on displaced migrants: psychological distress and psychosomatic complaints among refugees in Sweden - Sundquist J et al. 2000 (312)	Paper published from a study already included
Ethnicity, self reported psychiatric illness, and intake of psychotropic drugs in five ethnic groups in Sweden - Bayard-Burfield L et al. 2001 (338)	Paper published from a study already included
Immigration and leisure-time physical inactivity: a population-based study - Lindstrom M et al. 2001 (387)	Data from Iranian migrants combined with other minorities
Ethnic differences in self reported health in Malmö in southern Sweden - Lindström M et al. 2001 (383)	Data from Iranian migrants combined with other minorities
High use of sedatives and hypnotics in ethnic minorities in Sweden - Hjern A. 2001 (311)	Paper published from a study already included
Is there equity in access to health services for ethnic minorities in Sweden? - Hjern A et al. 2001 (314)	Paper published from a study already included
Ethnic differences in daily smoking in Malmö, Sweden - Lindström M et al. 2002 (384)	Data from Iranian migrants combined with other minorities
Country of birth and body mass index: a national study of 2,000 immigrants in Sweden - Wandell PE et al. 2004 (306)	Paper published from a study already included
Ethnicity, acculturation, and self reported health. A population based study among immigrants from Poland, Turkey, and Iran in Sweden - Wiking E et al. 2004 (308)	Paper published from a study already included
Ethnic differences in social participation and social capital in Malmö, Sweden: a population-based study - Lindström M et al. 2005 (385)	Data from Iranian migrants combined with other minorities
The influence of ethnicity and length of time since immigration on physical activity - Dawson AJ 2005 (388)	Data from Iranian migrants combined with other minorities
United States	
The acculturation of Iranians in the United States - Ghaffarian S 1987 (389)	Not clear residency status (permanent versus temporary)
Ethnicity and health among five Middle Eastern immigrant groups - Meleis AI et al. 1992 (386)	Data from Iranian migrants combined with other minorities

Table 3.2 Included studies by country: type, title, sampling and response rate in the systematic review of the methods and themes of health-related research on the Iranian Diaspora

Author(s)/type /year of study/ reference	Title of study	Study sample/frame/ Size	Sampling method	Response rate
Australia				
Rissel C et al. (Quantitative) 1997 (305)	An application of 'Snowball' sampling among a small dispersed migrant population for health research.	Iranian born migrants (males & females) aged over 18 years living in Sydney (n=413).	Snowball sampling	99%
Momenzadeh S et al. (Qualitative) 2003 (313)	Iranian migrants' discourses of health and the implications for using standardised health measures with minority groups.	Iranian migrants (males & Females) residing in Australia aged 25-60 (n=31)	Snowball sampling	Not stated
Canada				
Yavari P et al. (Quantitative) 2005 (316)	Methodology to identify Iranian immigrants for epidemiological studies.	NA*	NA	NA
Netherlands				
Gerritsen AA et al. (Quantitative) 2006 (317)	Physical and mental health of Afghan, Iranian and Somali asylum seekers and refugees living in the Netherlands.	Asylum seekers (residing in Netherlands) & refugees (residing in three municipalities of Arnhem, Leiden and Zaanstad) born in Afghanistan, Somalia and Iran (n=410)	Random sampling from Population Register	53% for Iranian refugees
Norway				
Holvik K et al. (Quantitative) 2005 (318)	Prevalence and predictors of vitamin D deficiency in five immigrant groups living in Oslo, Norway: the Oslo Immigrant Health Study.	Migrants aged 31-60 years born in Turkey (n=87), Sri Lanka (n=155), Pakistan (n= 94), Vietnam (n= 47), Iran (n= 108) living in Oslo	Inclusive sampling (Random sampling for Pakistanis)	38.8 % for Iranians
Sweden				
Hjern A et al. (Quantitative) 2000 (307)	Dental health and access to dental care for ethnic minorities in Sweden.	Residents (males & females) from four minority groups living in Sweden aged 27-60 born in Chile (n=548), Turkey (n=495), Poland (n=534) and Iran (n=312) with Swedish born matched adults (n= 2452)	Random sampling from Sweden's Register of The Total Population	68.1% for Iranians and 80.6% for Swedish

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Table 3.2 Included studies by country: type, title, sampling and response rate in the systematic review of the methods and themes of health-related research on the Iranian Diaspora (continued)

Author(s)/type /year of study/ reference	Title of study	Study sample/frame/ Size	Sampling method	Response rate
Sweden				
Daryani A (Quantitative) 2005 (320)	Risk factors for coronary heart disease among immigrant women from Iran and Turkey, compared to women of Swedish ethnicity.	First generation immigrant women born between years 1933-1962 from Turkey (n= 90), and Iran (n= 90) residing in Uppsala for at least 3 years with Swedish born matched women (n= 90)	Random sampling from Swedish Statistical Agency Register	79% for Iranian and 54% for Swedish women
USA				
Hanassab S (Quantitative) 1991 (304)	Acculturation and young Iranian women: attitudes toward sex roles and intimate relationships.	Iranian young migrant women aged 17-32 residing in Los Angeles (n=77)	Convenience sampling	Not stated
Lipson JG (Quantitative) 1992 (321)	The health and adjustment of Iranian immigrants.	Iranian migrants (Interview with 35 persons and sending of a questionnaire by post to 200 persons) residing in three San Francisco Bay Area counties.	Snowball sampling	Not stated for those invited for interview and 19% for postal questionnaire.
Chaichian MA (Quantitative) 1997 (298)	First generation Iranian immigrants and the question of cultural identity: the case of Iowa.	First generation Iranian Immigrants (males & females) aged 18 years and older (n= 70) who reside in a 30 mile radius of Iowa city	Convenience sampling	57%
Mahdi AA (Quantitative) 2001 (390)	Perceptions of gender roles among female Iranian immigrants in the United States.	Iranian migrant females residing in the USA (n= 158)	Random Sampling from one cultural and two scholarly associations	21.3%
Higgins PJ (Qualitative) 2004 (299)	Interviewing Iranian immigrant parents and adolescents.	Iranian families residing in Santa Clara County who have school aged adolescents (n= 101)	Convenience sampling	About a third of eligible families
Barnes DM et al. (Qualitative) 2005 (319)	Refugees' perceptions of healthy behaviour.	Adult refugees (males & females) aged 19-71 from Cuba (n=10), Bosnia (n= 11), Iran (n= 10)	Snowball sampling	91% (overall)

* Not applicable

The data collection technique, study site, use of translated or original questionnaires and language in the interview is provided in Table 3.3. Postal questionnaire and face to face interview were used simultaneously in 3 studies (298, 304, 321) (25%). In five studies (41.7%) only face to face interview was used. (299, 307, 313, 317, 319) Telephone interview was used in one study (305) (8.3%). Self administered questionnaires along with clinical examination and para-clinical tests were applied in two studies (16.7%). (318, 320) In one study (8.3%) only a postal questionnaire (390) was used.

Place for data collection among eight studies using face to face interview was not reported in two (25%) articles, (298, 321) in four studies (50%) it was the participants' homes (307, 313, 317, 319) while in two studies (25%) both participants' homes and researchers' offices were used. (299, 304)

In two studies (16.7%) clinical data were collected (318, 320). Of six studies (50%) where postal or self administered questionnaire were used (298, 304, 318, 320, 321, 390) three (50%) did not refer to translated questionnaires. (298, 304, 390) In the remaining three studies (318, 320, 321) translated questionnaire were applied.

Telephone or face to face interview was reported in nine (75%) studies (specifically or in combination with other methods). In three (33%) studies (299, 307, 321) both original and translated set of questions (optional) were used; and in one (313) only an English version of a questionnaire was used during interviews. To answer interview questions, interviewees in one study (313) used Persian, in four (299, 305, 319, 321) (44.4%) Persian and English, in one (317) (11.1%) Persian and Dutch and in one (307) Persian and Swedish. In two studies (298, 304) authors did not refer to the language of interview.

3.4.2 Studies on research methods on Iranians

Three studies (299, 305, 316) discussed methodological aspects of doing research on Iranians abroad, as summarised in Table 3.4.

Rissel and Khavarpour (305) referred to obstacles to use more reliable sampling methods among Iranian migrants e.g. being a small dispersed community within the original population, not having ethnically identifiable names or surnames and sensitivity

Table 3.3 Included studies in the systematic review of the methods and themes of health-related research on the Iranian Diaspora by country, the applied data collection technique and language

Title of Study/author(s)/ year of study/ reference	Data collection technique	Data collection place	Language of questionnaires	Language in interviews
Australia				
An application of 'Snowball' sampling among a small dispersed migrant population for health research. Rissel C, Khavarpour F – 1997 (305)	Telephone interview	NA*	NA	Persian in 90% cases, English in 10% of cases
Iranian migrants' discourses of health and the implications for using standardized health measures with minority groups. Momenzadeh S, Posner N – 2003 (313)	Face to face interview	Mostly at participants' home	English version	Persian
Netherlands				
Physical and mental health of Afghan, Iranian and Somali asylum seekers and refugees living in the Netherlands. Gerritsen AA et al. – 2006 (317)	Face to face interview	Participants' place of living	Translated version of Persian	Persian or Dutch
Norway				
Prevalence and predictors of vitamin D deficiency in five immigrant groups living in Oslo, Norway: the Oslo Immigrant Health Study. Holvik K et al. – 2005 (318)	Self administered questionnaire, clinical examination and para-clinical tests	Study site	Not stated	Not stated
Sweden				
Dental health and access to dental care for ethnic minorities in Sweden. Hjern A, Grindefford M – 2000 (307)	Face to face interview	Participants' homes	Translated version of (Persian) and Swedish on request	Persian in 10% of cases, Swedish in 90% of cases
Risk factors for coronary heart disease among immigrant women from Iran and Turkey, compared to women of Swedish ethnicity. Daryani A et al.- 2005 (320)	Self administered questionnaire, clinical examination and para-clinical tests	Participants' homes and research site	Translated version (Persian)	NA*
USA				
Acculturation and young Iranian women: attitudes toward sex roles and intimate relationships. Hanassab S – 1991 (304)	Postal questionnaire or face to face interview	Participants' home or researcher office	Not stated	Not stated
The health and adjustment of Iranian Immigrants. Lipson JG et al.- 1992 (321)	Face to face interview and postal questionnaire	Not stated	Translated (Persian) and non-translated (English) version	Persian and English on request

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Table 3.3 Included studies in the systematic review of the methods and themes of health-related research on the Iranian Diaspora by country, the applied data collection technique and language (continued)

Title of Study/author(s)/ year of study/ reference	Data collection technique	Data collection place	Language of questionnaires	Language in interviews
USA				
First generation Iranian immigrants and the question of cultural identity: The case of Iowa. Chaichian MA – 1997 (298)	Postal questionnaire or face to face interview	Not stated	Not stated	Not stated
Perceptions of gender roles among female Iranian immigrants in the United States. Mahdi AA – 2001 (390)	Postal questionnaire	NA	Not stated	NA
Interviewing Iranian immigrant parents and Adolescents. Higgins P J – 2004 (299)	Face to face interview	Participants' home, Place of work and coffee shops or researcher's office	Translated (Persian) and non translated (English) versions	Almost all in Persian
Refugees' perceptions of healthy behaviour. Barnes DM, Almasy N – 2005 (319)	Face to face interview	Participants' home	NA	English and Persian on request

* Not applicable

of study subject (e.g. sexual behaviour or illegal drug use). They recruited four bilingual interviewers born in Iran representing different sub-groups of Iranians. Interviewers then contacted eligible persons via telephone to encourage them to answer study questions and to give telephone numbers of up to four adult friends or relatives (not immediate family members) with a parent born in Iran. To avoid selection bias the number of contacts each participant could suggest was limited. The project was also publicised through the local Iranian radio station. The response rate was 99% (417/428). Interviews took place in Persian in 90% and the remaining in English. The sample was similar in regard to sex and age to residents born in Iran in the 1991 census of the Sydney Statistical Area. The snowball sampling method generated a more educated and wealthy sample than the population of migrants from Iran to Australia.

Higgins' review (299) referred to studies which indicate high educational and economic status of Iranian migrants. She stated that residing in the same area does not guarantee researchers contact with Iranians and that the offer of paying people for their time is unlikely to increase participation. She reported strong suspicion among Iranians of strangers asking questions and that only those with strong ties to the community can be successful in research on this ethnic group. She referred to studies which reflected participants' cooperation and eagerness to participate. Factors like appeals to national or ethnic pride, choice of language and place of interview were helpful in convincing Iranians to participate. She reported finding only one study where a formal informed consent procedure was followed. In several studies a tendency among Iranian migrants to present oneself, one's family and one's community in the best possible light had been observed.

Higgins used a list of Iranian families' names, phones and addresses provided by school administrators or Iranian networks to send letter or make a telephone call to recruit Iranians. She consented of 101 families to participate, which was only one third of the eligible families. She permitted the study participant to choose the language of interview and between a non-Iranian and an Iranian interviewer. Most interviews were in the family home but interviewer's office, participants' place of work and coffee shops also were used. Participation rate reported to be one third of eligible families.

Table 3.4 Included studies that focused on methodological issues in the systematic review of the methods and themes of health-related research on the Iranian Diaspora

Author(s) / year of study/ reference	Title of Study	Study design	Study place	Main methodological issue
Rissel C, Khavarpour F 1997 (305)	An application of 'Snowball' sampling among a small dispersed migrant population for health research	Population-based	Australia	Sampling (Snowball)
Higgins PJ 2004 (299)	Interviewing Iranian immigrant parents and adolescents	Population-based	USA	Data collection (interviewing)
Yavari P et al. 2005 (316)	Methodology to identify Iranian immigrants for epidemiological studies	Population-based	Canada	Recruitment method: (Searching Iranian surnames and given names in the databases to make contacts)

Higgins concluded that Iranians were not over-sensitive, sceptical or cynical and were typical of the Iranian community in the area. The commonest reason for refusal was lack of time. She recommended that personal contacts and snowball sampling were the most effective ways of recruiting Iranian migrants.

Yavari et al. (316) identified Iranians in British Columbia (BC), Canada. They listed common Iranian surnames and given names from a local residential telephone book and the Screening Mammography Program of BC database. They linked this list with the BC Cancer Agency to identify Iranians who had been diagnosed with cancer. Sensitivity of this approach to detect Iranians was reported to be up to 97% for surnames.

3.4.3 Population based studies on Iranian minority group: additional key points from identified papers

In three studies (30%) only females were included (304, 320, 390). Two studies (20%) were among Iranian refugees and asylum seekers, (317, 319) other studies were on Iranian migrants. Iranians were studied in five studies with other migrants in a collective sample. (307, 317-320)

Hanassab in her study (304) on Iranian women in Los Angeles, USA used a postal questionnaire. There was selection of better educated persons from higher socio-economic backgrounds. Socio-economic difference between respondents and non-respondents also was found to be a methodological limitation of the research by Wandell et al. (306) Hjern and Grindeffjord (307) reported that Iranians had the highest level of education among migrants. They identified higher dropout rate in the minority sample as one of their study's limitations.

The study of Wiking et al. (308) about self reported health among immigrants (including Iranians) in Sweden revealed that people in older age groups, females and those living in small cities are over represented in the study group. Among Iranian non-respondents 21% reported no income while in the respondents group it was 7%. Higher non-response rate among immigrant groups than the Swedish control group was a stated limitation in this study.

Iranian migrants residing around Iowa City, USA were sent a postal questionnaire or interviewed in a study by Chaichian (298) Response rate to postal questionnaires was

57% and participation rate for interview was 17.14%. Iranians who participated were highly educated compared to the larger urban concentrations of Iranians.

Mahdi (390) mailed a questionnaire with 113 questions to a number of Iranian families residing in 41 states of USA. The study target group included Iranian females randomly drawn from address list of one cultural and two scholarly associations in the US. Response rate in this study was 21.3% (excluding returned questionnaires due to incorrect address). The sample was biased towards a more educated and professional sample.

Barnes and Almasy (319) studied refugees' perceptions of healthy behaviours. Overall participation rate for the study sample (including Iranians) was reported as 91%. The study researchers suggested not including refugees from various parts of the world in one sample without separating the data according to the similarities and differences between groups.

In a qualitative study by Momenzadeh and Posner (313) snowball sampling was used to recruit Iranians from different socioeconomic backgrounds in Australia. An English version of the questionnaire was used but interviewees were asked to respond to questions in Persian.

Lipson et al. (321) sent English and Persian (translated and back translated) versions of a standard questionnaire to 200 selected Iranians of which only 19% were returned. She suggested that this poor response rate could have resulted from distaste for written surveys, a preference for face to face interview or mistrust of research among Iranians in the San Francisco area.

3.5 Discussion

This is the first systematic review of recruitment methods in health studies of Iranians living abroad. Relatively few studies were found but considerable heterogeneity in the methodologies used. From 22 relevant articles, 13 unique studies met the inclusion criteria. One reported methodology of linking two databases of names and surnames to find Iranians. (316) In four articles there was missing information about important aspects of the methodology. Place of data collection (298, 321) or application of

translated versus original questionnaires (298, 304, 390) and language of interviews (298, 304) had often not been declared.

The wide range of participation rates from 19% to 99% most likely represents both differing recruitment and study methods. No single method of recruitment can be considered a gold standard. Similar methods in varying circumstances lead to differing results. For instance a random sampling method to recruit Iranian women resulted in participation rate of 21% in one study (390) and 79% in another. (320) Snowball sampling was reported to be a successful way to recruit Iranians. To avoid selection bias where marginalised people are less likely to be nominated, researchers should limit the number of contacts each participant could introduce. Snowball sampling generated a more educated and wealthy sample than the general population of Iranian migrants in a number of studies. Participation rate where snowball sampling was used to recruit Iranian males and females (321) was reported to be as low as 19% and as high as 99%. (305) In the study by Hjern and Grindekjord (307) face to face interview method in the participants' home resulted in participation rate of 68% but in the study by Gerritsen et al.(317) the participation rate was 53%. Factors at play in these variations include time and place of study (country, city, district etc), migration status, level of education, subject of the research and measurements made in each individual study.

It is vital to understand the factors persuading or inhibiting participation by Iranians living abroad. Given the small number of studies on this ethnic minority and the diversity of methodologies it is not possible to analyse these results statistically, but they can help other researchers. Based on these results, it can be concluded that Iranians have high levels of education and economic status in comparison with the other ethnic minority groups, that those participating have higher socio-economic status than those not doing so, but that useful studies are achievable for a variety of settings, countries and topics.

To increase participation of Iranians factors suggested included: application of a multi method approach to recruit Iranians; translation of the study questionnaire, brochure and declaration of consent in the respondents' language; emphasising anonymity; choice of interviewer (examiner), language, time and place of interview; contacting of respondents

by letter and in person; using an oral informed consent procedure; publicising the study through the local Iranian radio station; and giving financial incentives. (299, 305, 313, 317)

There was discussion about distaste for written surveys, strong suspicion of strangers asking questions among Iranian migrants and that only those with strong ties to the community can be successful in research on this ethnic group. (293, 307) One study (309) avoided distributing a formal consent form to prevent participants being reminded of earlier confrontations with legal authorities but in most studies no hesitance was seen among Iranian migrants in giving consent. Overall, however, there was evidence reflecting Iranians cooperation and eagerness to participate in research. Lack of engagement on the part of Iranians is unlikely to be a barrier to research: institutional barriers are likely to be more important.

The limited data available suggest that the majority of Iranian migrants will speak the language of their adoptive countries and relatively few will require translation services.

In this review literature written in English or Persian language was searched but a sizeable number of Iranians are living in countries where other languages are used and articles or reports may be published in local languages (France, Denmark, Germany, Norway, Sweden). For this reason probably some articles or reports were missed from these countries. Searching procedure in this systematic review was limited to the websites written in English or Persian while there are many other websites (non English) in which potentially relevant articles could be found. In the future researchers should try to expand the search domain to the non English/Persian language through collaboration with other researchers internationally who read these other languages.

To the best of current knowledge, there is no available published systematic review on the methods and themes of health-related research on the Iranian Diaspora. This systematic review has been undertaken to establish a baseline to inform future studies on Iranian migrants. The findings fill the knowledge gap and can help researchers to meet the challenges may rise in doing research On Iranian ethnic group.

There is now a considerable and growing population of Iranian migrants throughout the World. Iranian culture will transfer from the migrant generation to the offspring born

in the receiving country. However it will be affected by the culture of host countries concurrently. Study of determinants of health and quality and quantity of health care in this ethnic minority is now important in international health. This review shows that such studies are sparse (none in the UK), needed and feasible. This review shows that wide span of topics can be studied. Heart disease, stroke, diabetes, cancer and mental illness are a few of the major health problems of Iranians overseas (and in Iran). No studies on diabetes, stroke and cancer were found and only meagre work on the other topics was retrieved. In the interests of equity of health care, and in response to health policies and legislation promoting equality, research is mandatory. Results of this systematic review call on the research community to take head of the needs and opportunities identified here.

3.6 Research update: Studies published since the date of this systematic review

Literature search in this systematic review was conducted in April 2006 to provide baseline information needed for planning of a population based pilot study on Iranian migrant population in Edinburgh. To check whether any relevant study has been carried out since the date of this systematic review a rigorous search was performed in Feb 2009. Thus 18 additional potential publications (392-409) were found to report studies that were conducted on Iranian Diaspora in different countries (one in Australia, (400) three in Canada, (392, 394, 397) three in Norway, (393, 404, 407) eight in Sweden (398, 401-403, 405, 406, 408, 409) and three in the United States (395, 396, 399)). Among the retrieved articles (393, 400, 404, 405, 407) only five were written by non-Iranians authors. Nine articles (392, 394, 396, 399, 404-407, 409) were excluded since they were not reporting a population based study.

Nasseri (396) has attempted in his study to create and validate a list of common Middle Eastern surnames for epidemiological research. He used place of birth and surnames already present in the various lists in the United States to construct the proposed list. Then he applied the created list on the California Cancer registry to find accuracy of the list in finding the surnames from different countries in the Middle East. The accuracy of the list to find Iranian surnames for instance was reported to be 94.63

%. Thus he concluded that while the Middle East consists of a mosaic of countries with different cultures and languages, construction of a surname list that can identify different ethnic subgroups originating from the region is possible with reasonable accuracy.

Five studies (393, 398, 402, 403, 408) were publications of same studies conducted in Norway (393) and Sweden (398, 402, 404, 408). Due to use of an identical methodology in multiple publications, one sample article was included from each group of the publications. The article by Kumar et al (393) was another publication based on the data from Oslo Immigrant Health study. Since an earlier publication (391) was already included in the systematic review so this article was excluded. The articles were published by Daryani et al (398, 402) were different publications from a same study on first-generation immigrant women born in the Middle East in Uppsala, Sweden. By the same token since an earlier publication (320) of the study was included in the systematic review these two articles were excluded too. Three articles (401, 403, 408) were different publications from a study was conducted in the township of Kista in Stockholm of Sweden. Thus only one of the articles (401) was decided to be scrutinised further according to the objectives of this systematic review.

Therefore from a total of eighteen identified studies which were published since the date of this systematic review only four studies (395, 397, 400, 401) were eligible for further assessment.

In the study of Shirazi et al (395) snowball sampling has been used to recruit Iranian women aged 30-75 years in California, the United States. From those who were invited (520 people) by letter or verbally (2003) to be assessed by a questionnaire for breast cancer self examination practices only 361 accepted to participate yielding a 69.4% response rate. In this study the investigators have used a multi-method recruitment strategy (contacting community centres, Iranian schools, women's group and mosques along with publicising the study in the community newsletter and Persian news websites, attending the Iranian's informal gatherings in several events) to provide broad socio-economic participation. The study respondents have been offered a free T-shirt for their voluntary participation. About 65.7% of those consented to participate in the study had at least college degree which may be an indication of selection bias or as it was stated in

other studies (298, 299, 304) reflection of Iranians overall higher education level compared to the other ethnic minorities in destination countries. Self administered original English questionnaire which also was tested for cross-cultural validity have been applied for data collection in this study.

A combination of quantitative (structured telephone questionnaire) and qualitative (follow-up focus groups) methods were employed (2004-05) in the study of Poureslami et al (397) to assess the effectiveness of informational video clips (that were translated into Persian) on the Iranian migrants' attitude and intention to use health programmes in the Vancouver, Canada. The study sample was randomly selected using the Iranian yellow pages and telephone books. All Iranian adults aged 19 years or over were eligible to participate in the study. The initial telephone interview was administered in Persian and from 800 Iranian residents in the greater Vancouver area who were contacted 590 people (mostly women in the age range of 35-64) agreed to participate (participation rate was 73.75%). In the qualitative stage of the study 98 randomly selected volunteers from the telephone interview phase were asked to participate in focus group sessions. But participation rate for this stage and place of focus group discussions were not provided by the authors.

In the study of Neale et al (400) Iranian residents aged 18 years or over along with two other ethnic groups were investigated (October 2003-March 2004) for their knowledge and use of health services and also satisfaction about the delivered services in Victoria, Australia. Face to face interview and focus group discussions were the data collection methods. The study questionnaires for Iranian migrants were translated only verbally into Persian and the responses were recorded during the interviews. The study interviewers in relation to the Iranian participants were native bilingual Iranians who were trained about the study aims and data collection methods. The initial target sample size for each of the studied ethnic groups (including Iranians) in this study was 50 with equal gender distribution but only 10 male and 13 female Iranians were managed to be recruited (46%). Initial recruitment was performed through advertising the study in the community organisations and radio programmes in appropriate language and snowball sampling technique was used to extend the sample. Place of interview was not

mentioned in the study report and the authors referred to a degree of reluctance to sign the study consent form by the participants in spite of reassurance was given with regard to the study aims and anonymity of the results.

All Iranian-born people aged 60-84 years (286 residents) in the township of Kista, Stockholm in Sweden were invited (the date was not given) by Koochek et al. (401) in their study on health-related quality of life. The invitation was taken place via a letter written both in Swedish and Persian. The participation rate was reported to be 65%. The non-respondents also were contacted by the investigators and no difference was seen between the respondents and non-respondents with regard to gender, education and self-reported health. The interviews were conducted face to face in Persian but the interview places were not mentioned in the study report.

These additional studies extended scale of our knowledge about methodology of research on Iranian Diaspora and indicated variation of the methods and heterogeneity of the findings in studies on Iranian Diaspora.

3.7 Abstract

Introduction: Iranian migrants are dispersed within the general population in the destination countries. It is UK policy mandates that we provide equal access to health and health care for all ethnic minorities. The research evidence on which to base health care planning and provision decisions for the Iranian Diaspora is, however, very limited. In order to learn lessons to apply to future planned epidemiological research this study aimed systematically to review methods used in population-based health research on Iranians.

Methods: Nine databases along with other electronic resources such as web pages of ethnicity related organisations or official health organisations of countries known as having a fair number of Iranians and potentially pertinent Internet sites were searched. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines were used to report findings of this systematic review.

Results: From 31 relevant articles, 17 unique studies met the inclusion criteria. Considerable heterogeneity was seen in the methods and findings. Participation rate was in the range of 19% to 99% among the eligible studies. Random sampling method to

recruit Iranian women resulted in participation rate of 21% in one study and 79% in another. Given the small number of studies on this ethnic minority and the diversity of methodologies, it was not possible to analyse these results statistically. Overall, the study findings showed Iranians' cooperation and eagerness to participate in research.

Conclusion: This review as the first study of applied methods in health research on Iranian migrants showed huge gaps in the evidence base. The findings also indicated that no single method of recruitment can be considered a gold standard to recruit Iranians living abroad. Findings of this systematic review helped planning of a pilot UK based study on the Iranian ethnic group which is discussed in chapter five and six.

Chapter four: Risk factors of cardiovascular diseases among Iranians: a systematic review of prevalence studies

4.1 Introduction

In the previous chapter findings from the systematic review on the methods and themes of health related research on the Iranian Diaspora were provided. The review has shown that health related studies on Iranian Diaspora are sparse while there is now a considerable and growing population of Iranian migrants throughout the World. There are no such studies in the UK whereas in the interests of equity of health care, and in response to health policies and legislation promoting equality, research on the health of all ethnic minorities is mandatory.

We know very little about the prevalence of CVD risk factors in the Iranian migrant population. There is no comprehensive systematic review of studies on the prevalence of CVD risk factors ever undertaken among Iranians and for this reason interpretation and comparison of the results is burdensome.

The recommended structure (PICO: Population, Intervention, Comparison and Outcome) of Glasziou et al. (290) in systematic reviews of health studies was applied to frame main question in this systematic review. Estimation of the prevalence of conventional CVD risk factors (outcome) among Iranians (population) was a major component of the study question. All efforts were made to identify and assess accuracy and the quality of the methods used in all eligible studies. This is a basic step to prepare for new studies on the prevalence of CVD risk factors among Iranian migrants or even Iran's general population.

This chapter describes the protocol and findings of this systematic review which was carried out to answer some of the outstanding questions prior to planning of a prevalence study on the major CVD risk factors in the Iranian ethnic group living in the UK.

4.2 Background

Cardiovascular disease is a major cause of death and morbidity throughout the world and ranked as the leading cause of death in many countries. (46) Most of these deaths are preventable by control of contributing risk factors such as hypertension, diabetes, smoking, physical inactivity and nutritional behaviours. But due to the widespread inadequacy of preventive measures, CVD is still the leading public health threat in many developed and developing countries. (52) A predominant gap between developed and developing countries and even among subgroups of population within individual countries has been reported regarding the CVD related morbidity and mortality. (60) Such a gap also was suggested to exist among ethnic migrant groups compared to the indigenous population in the destination countries and population of the country of origin. (47-51) The discrepancy was indicated to be attributable to the differences in the associated CVD risk factors among population subgroups. (61) The study of subjects separated from their original environment and cultural background and adapted to a new sociocultural environment may provide a tool for assessing cultural, environmental and genetic factors on occurrence of the disease.

Iran as a transitional country is encountering a rapid change towards industrialisation. Expanding urbanisation and subsequent alteration in life style (e.g. nutritional habits and physical activity level) are major consequences of this change that in turn have had substantial impacts on the occurrence of some major diseases among them CVD is leading. (410)

As shown in the previous chapter despite increasing numbers of Iranian migrants in the major destination countries (including the UK), research evidence to base our knowledge about CVD health status of this ethnic group is scant. In this review present body of literature about the prevalence of CVD risk factors among Iranian adult indigenous and migrant population was examined. The ultimate goal was to establish baseline data about the burden of CVD risk factors among Iranians based on sound

evidence. Expected findings can inform the process for designing of a future relevant study and also decisions about how to prioritise resources in favour of most needed area.

4.2 Methods

4.2.1 Types of studies

All studies that have measured the prevalence of CVD risk factors among Iranians were considered eligible provided they focused on Iranians (and not foreign-born refugees residing in Iran) living inside or outside of Iran. Any published study was included in this review if it reported sampling method, sample size, recruitment criteria, methods and tools of data gathering and CVD risk factors.

4.2.2 Types of data

- Data on the place of study, sampling method and sample size, recruiting criteria, participation rate, data collection methods, analysis methods and techniques and quality of the findings report.
- Data on socio-demographic characteristics of subjects in the studies i.e. age, sex, level of education, occupation and marital status.
- Data on physical activity status, cigarette smoking, anthropometric measures, blood pressure level, level of total cholesterol, high density lipoprotein (HDL-C) and low density lipoprotein (LDL-C) cholesterol in blood, diabetes and taking of medication for controlling of these risk factors.

4.2.3 Types of outcome sought

- Number of studies having good quality information on the applied methodologies (sample size, sampling method, sampling frame and recruitment criteria of subjects, participation rate).
- Number of studies having good reporting quality.
- Prevalence of physical inactivity.
- Prevalence of smoking.
- Prevalence of being overweight, obese or having central obesity based on anthropometric indices such as Body Mass Index (BMI).
- Prevalence of hypertension based on resting blood pressure.

- Prevalence of hyperlipidaemia based on concentration of blood lipoprotein (LDL-C, HDL-C).
- Prevalence of diabetes.
- Prevalence of CVD related signs and symptoms.
- Prevalence of CVD related medication taking (to verify detected CVD among studied subjects).

4.2.4 Search strategy

The free text and MeSH (Medical Subject Headings) indexing terms (Appendix five) were used to search the following databases that were considered to be most relevant in terms of objectives of this systematic review:

- AMED (Allied and Complementary Medicine) (1985 to March week 4, 2009).
- CAB Abstracts (1973 to March 2009).
- CINAHL (Cumulative Index to Nursing & Allied Health Literature) (1982 to March week 4, 2009).
- EMBASE (1980 to March, 2009).
- Global Health (1973 to March 2009).
- Index to theses (A comprehensive listing of theses with abstracts accepted for higher degrees by universities in Great Britain and Ireland since 1716) (1716 to March week 4, 2009).
- International Bibliography of the Social Sciences 1951 to March week 04, 2009).
- MEDLINE(R): 1950 to 1965, 1966 to March week 4, 2009 and In-Process & Other Non-Indexed Citations (March 31, 2009).
- National Research Register (UK).

Other electronic resources regarded as appropriate such as web pages from Iranian Ministry of Health and Medical Education (MOHME) or medical universities in Iran for official information and other potentially relevant internet sites (PubMed, Google) were also explored to identify any other published or unpublished work.

This review was limited to English or Persian language studies published between 1950 up to March 2009. The titles and abstracts of all retrieved records were screened to

identify apparently related articles. Articles were only rejected on initial screen if it was clear from the title and abstract that the article was not a report of a CVD related prevalence study. When a title/abstract could not be rejected with certainty, the full text of the article was obtained for further evaluation. As well as the above-mentioned strategies, references of relevant articles were checked to identify additional studies. It was also decided to include studies recognised through serendipitous discovery (such as finding a relevant article when looking for something else) in this review. To reduce the possible effects of publication bias, experts (Professor M Janghorbani, Dr. F Khavarpour, Dr. R Kelishadi, Professor H Meyer and Dr. S Momenzadeh,) who were well known to do work in the area were also contacted for references not identified through the search process.

4.2.5 Data extraction

Reference Manager Software (version 10) was used to download the citations identified in electronic search process and to enter those retrieved from other sources manually.

A data extraction sheet was used for summarising included studies (Appendix six). These studies were also assessed for their quality according to the internal and external validity criteria (Appendix seven). Data in the data extraction sheet double checked by one of the study supervisors (Professor Aziz Sheikh) and disagreements were resolved by consensus.

Information was extracted for each included study on the following areas: study and setting, protocols applied for measurement and reporting of variables, control of confounding factors, use of a representative sample and declaration of participation rates, proper explanation of the non-participants' characteristics, calculation and providing of confidence intervals and age adjusted sex specific rates for the reported prevalence rates.

Due to use of US units in Iran to report level of biochemical factors in blood analysis the reported quantities in US units (mg/dl) were converted into SI units (mmol/l). To do so, quantities of triglycerides in US units were multiplied by 0.011 and those of total

cholesterol, high density lipoprotein and low density lipoprotein multiplied by 0.0259 to have the quantities in SI unit.

4.2.6 Data analysis

Results of this systematic review were tabulated based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement (302, 303). The retrieved studies were summarised chronologically by title, name of the researcher(s) and location and presented in descriptive form. Meta-analysis was performed using Comprehensive Meta Analysis (CMA) software (version 2.2.046) to incorporate data from eligible studies.

In order to ensure that the reported sex specific prevalence rates of major CVD risk factors in different studies are comparable, they were standardised by using the latest Iranian population census data (Appendix eight). Heterogeneity indices were calculated based on a subgroup analysis and discussed for each group of studies separately when dealing with the sex specific age adjusted prevalence rates of different CVD risk factors. Thus Q-value as the test of dispersion of outcome measures and I-squared (I^2) to indicate the amount of variance among the included studies as a proportion of the total variance (411) were presented separately along with the estimated pooled prevalence rates. Fixed effect model was used to estimate overall pooled prevalence rates or mean levels of the studied CVD risk factors when no evidence of heterogeneity was seen among the included studies. Random effects model was applied when such heterogeneity was observed according to the test results. (411) Fixed or random effects models in the subgroup analysis were used to combine data only across those studies that have not major issue of internal validity (analysis of the data started with a fixed effect model and if there was a empirical evidence of heterogeneity random effects model was applied). Where possible, confidence intervals for prevalence rates or age adjusted prevalence rates have been calculated based on the data provided in the eligible articles. These measures were discussed considering all limitations that may exist in the meta-analysis of the methodologically divergent prevalence studies.

Application of funnel plot as a primary visual tool for the investigation of possible publication bias and use of a proper numerical approach to show any evidence of asymmetry was also discussed where appropriate.

4.3 Results

Search of the proposed databases yielded 1470 articles (Figure 4.1). Non-relevant and duplicate articles were eliminated in two stages and thus 254 potentially applicable articles remained for further scrutiny. A further 27 candidate articles were also identified by reviewing other electronic resources (e.g. web pages of Iranian organisations, PubMed and Google), references of the potentially applicable articles, serendipitous discovery and contacting of researchers or experts who were known to do work on this subject (Professor M Janghorbani, Dr H Soori, Dr R Kelishadi and Professor F Azizi from Iran, Professor HE Meyer from Norway). As a result 281 potentially appropriate articles were scrutinised and 104 of them met the inclusion criteria. The full texts of these possibly relevant articles were obtained and inspected. Some studies had been described in more than one publication. In some cases, additional analyses of a study were reported. In these cases, it was decided to include the analysis that provided the most information and avoided duplication of results. A number of publications did not meet the inclusion criteria and were excluded consequently. Thus from 104 articles, which met our initial criteria, 63 were multiple publications of the 5 main studies in Iran and in 13 articles usable information was not provided or format of the provided data was not applicable for the purpose of this systematic review.

Azizi et al. had 41 publications (412-452) from Tehran Lipid and Glucose Study (TLGS) reporting prevalence of several CVD risk factors or discussing genetic, biological, or environmental determinants of CVD in a representative population of Tehran. Only one main article (416) was selected to be included in this review. Concurrently from 17 publications (453-469) mainly by Sarraf-Zadegan and (or) her colleagues in the Isfahan Cardiovascular Research Centre (ICRC) seven publications (453, 454, 456, 459, 466, 468, 469) were included in this review based on data from Isfahan Healthy Heart Programme (IHHP). Sarraf-Zadegan et al. (469) in their recent publication and based on an updated analysis of previously presented data (456) have

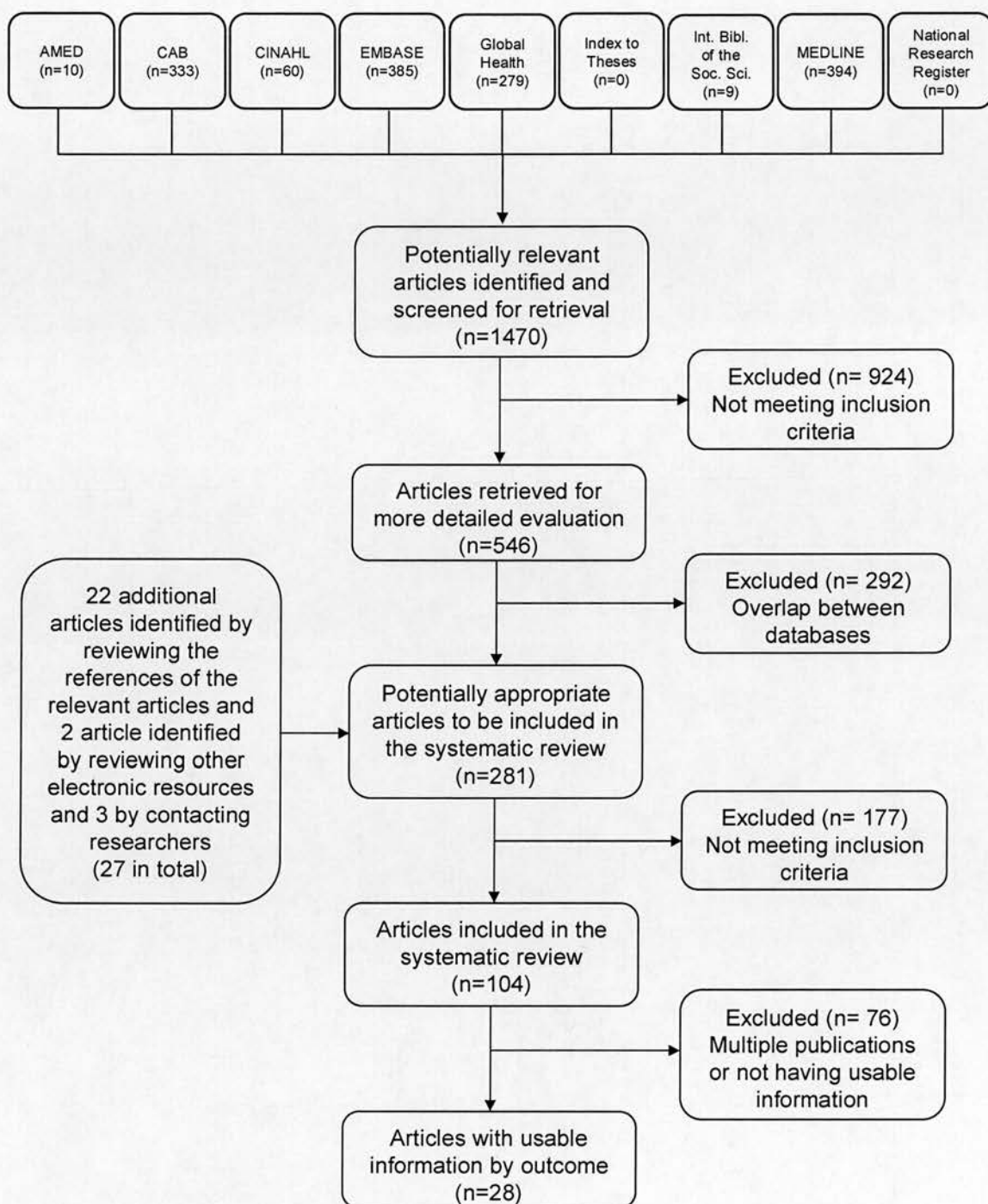


Figure 4.1 The PRISMA flow diagram: number and status of the identified articles in the systematic review of prevalence studies on the risk factors of cardiovascular diseases among Iranians

provided information about the magnitude of CVD risk factors in Iran. Since data about a number of the CVD risk factors in the former published article were not provided in the later article both of them were included.

Among eight publications (470-477) of Fakhrzadeh et al. one article (471) which reported the prevalence of CVD risk factors in a representative population of Tehran was selected.

One article (478) was included from two publications (478-479) reporting the findings of a study in Ahwaz (capital city of Khozestan province)..

From a total of five articles (480-486) that represent four different studies in Fars province (in South West of Iran), three articles (482-484) were included.

Also separate publications that reporting the findings of several studies in different parts of Iran including city of Islamshahr (located in Tehran province) (485), city of Rafsanjan (located in Kerman province) (486), city of Bushehr (capital city of Bushehr province) (487), Khorasan province (488) and Semnan province (489) were also included.

Among a total of 11 publications (490-500) representing result of national surveys seven eligible articles (490-493, 496, 497, 499) were included (see Table 4.1 for excluded publications).

An article by Janghorbani et al. (498) indicating the prevalence of hypertension in Iran (based on the findings of a national survey on the prevalence of non-communicable diseases risk factors) was excluded since another article (499) using same database but reporting the standardised prevalence rate of hypertension was included. Haghdoost et al. (500) have reported findings of a systematic review on the epidemiology and heterogeneity of hypertension in Iran. They have included in this systematic review only those papers which were published between Jan 1996-Dec 2005. International (Medline) and also national or local databases have been searched in this systematic review to identify relevant studies. They have included 29 eligible publications in their review but excluded those reporting studies with sample size less than 300. The authors have presented the point estimate of the prevalence of hypertension based on the results of a national survey in different provinces separate from other studies. Unadjusted and non-

standardised prevalence rates were used in this review to estimate the overall prevalence rate of the hypertension in Iran. The identified papers were mostly those articles that had been published in non-indexed medical journals in Iran. Thus, availability bias (selection of easily accessible publications) could be regarded as a potential source of error in this systematic review. Based on the analysis of the findings, two point estimates (not sex specific) for the total prevalence rate of hypertension was reported (22.06% and 12.54%). The authors of this article have incorrectly concluded that the prevalence of hypertension in Iran is declining since by every one year increase in the articles' publication date they have noticed a 1.11% reduction in the prevalence of hypertension. Due to all these technical issues this article was also excluded.

In the article of Hatmi et al. (501) which was on the prevalence of coronary artery diseases risk factors in a representative sample of adults in Tehran, clear definition or measurement method for some of the studied variables (diabetes, smoking, physical activity) was not provided. Therefore, this article was also excluded.

One study from Rasht (capital city of Guilan province in the Northern part of Iran) which was conducted by Maddah (502) was excluded due to focus of study on the obese people, their blood lipids and fasting glucose levels.

Bahrami et al. (503), in the analysis of findings from their study on the prevalence of obesity and hypertension in the Golestan province (North of Iran), have adjusted the prevalence rates to the U.S standard population in 2000. They have not given crude age specific prevalence rates of the obesity and hypertension in their published paper so that a researcher can standardise these rates to an Iranian standard population. In this article the crude prevalence of self reported alcohol consumption was also presented which is very rare in the Iranian publications but due to the reason explained above it was decided to be excluded.

The report of a study by Chehrei et al. (504) which was conducted to clarify correlation of dyslipidaemia and anthropometric indices in Isfahan was also excluded since hypertensive and diabetic patients were not included in the studied sample.

In the study of Dastgiri et al. (505) in the North West of Tabriz (capital city of East Azarbaijan province) the prevalence of obesity was studied by recruitment of 330

randomly selected adults. The authors in their report have not provided age-adjusted or standardised prevalence rate of obesity nor data to be calculated by another researcher. Therefore this article was also excluded.

Another excluded article was a duplicate publication (in Persian language) of a previously included article (489) and written by Gorbani R et al. (506).

Another nine reports (305, 391, 507-513) were identified on Iranians living abroad that met the primary inclusion criteria. Among the identified studies on Iranian migrants, two were excluded (507, 510) since they had not any data about Iranian migrant population separately and their data were analysed cumulatively with other migrants. Two studies were multiple publications (508, 509) of a single study on a group of migrant Iranians abroad and so only one of them was included. (509) The study of Glans et al. (511) was on the diabetic patients and in two publications by Koochek et al. (512, 513) findings of a study on the Iranian elderly population settled in Kista, Stockholm were reported. Therefore all these three articles were excluded.

Thus from a total of 104 potentially relevant publications, 76 were excluded (Table 4.1) and 28 articles were scrutinised further. In the later group, 25 were original cross-sectional prevalence studies and three were narrative description of data gathered by an organisation (490, 493) or summary of studies conducted by others. (491)

4.3.1 Quality of studies

Eligible studies were classified into three groups (Table 4.2) based on a quality assessment procedure adopted mainly from methods developed by Siegfried et al. (514). This system included appraisal of studies based on external and internal validity criteria relevant to biases in the epidemiological studies.

Quality of these studies was independently evaluated by the main investigator and one of the study supervisors (professor Aziz Sheikh) and disagreements were resolved by consensus. From 27 included studies indirect method (self report) of observation to measure a quantitative variable was used in two studies. (305, 478) Results of these studies are prone to information bias since for instance weight or height measures were obtained by self report rather than direct measurement. Only in 16 publications (305,

Table 4.1 Excluded studies by title and reason of exclusion in the systematic review of the prevalence studies on risk factors of cardiovascular diseases among Iranians

Title of Study/author(s)/publication year	Reason for exclusion
Tehran (Tehran Lipid and Glucose Study)	
Dietary factors and body mass index in a group of Iranian adolescents: Tehran lipid and glucose study. Azizi F et al. 2001	Paper published from a study already included
Serum lipid levels in an Iranian population of children and adolescents: Tehran lipid and glucose study. Azizi F et al. 2001	Paper published from a study already included
Contraceptive methods and risk factors of cardiovascular diseases in Tehranian women: Tehran Lipid and Glucose Study. Azizi F et al. 2002	Paper published from a study already included
Distribution of blood pressure and prevalence of hypertension in Tehran adult population: Tehran Lipid and Glucose Study. Azizi F et al. 2002	Paper published from a study already included
Association of lipids, lipoproteins, apolipoproteins and paraoxonase enzyme activity with premature coronary artery disease. Azizi F et al. 2002	Paper published from a study already included
Determinants of serum HDL-C level in a Tehran urban population: the Tehran Lipid and Glucose Study. Azizi F et al. 2002	Paper published from a study already included
Familial clustering of obesity and the role of nutrition: Tehran lipid and glucose study. Mirmiran P et al. 2002	Paper published from a study already included
Association of educational level and marital status with dietary intake and cardiovascular risk factors in Tehranian adults: Tehran Lipid and Glucose Study. Mirmiran P et al. 2002	Paper published from a study already included
Coronary artery disease is associated with the ratio of apolipoprotein A-I/B and serum concentration of apolipoprotein B, but not with paraoxonase enzyme activity in Iranian subjects. Rahmani M et al. 2002	Paper published from a study already included
Coronary heart disease risk factors and menopause: a study in 1980 Tehranian women, the Tehran Lipid and Glucose Study. Azizi F et al. 2003	Paper published from a study already included
Cardiovascular risk factors in the elderly: the Tehran Lipid and Glucose Study. Azizi F et al. 2003	Paper published from a study already included
Serum lipid levels in an Iranian adults population: Tehran lipid and glucose study. Azizi F et al. 2003	Paper published from a study already included
Is systolic blood pressure sufficient for classification of blood pressure and determination of hypertension based on JNC-VI in an Iranian adult population? Tehran lipid and glucose study. Azizi F et al. 2003	Paper published from a study already included
Prevalence of metabolic syndrome in an urban population: Tehran Lipid and Glucose Study. Azizi F et al. 2003	Paper published from a study already included
Gender differences in dietary intakes, anthropometrical measurements and biochemical indices in an urban adult population: the Tehran Lipid and Glucose Study. Mirmiran P et al. 2003	Paper published from a study already included
Estimation of energy requirements for adults: Tehran lipid and glucose study. Mirmiran P et al. 2003	Paper published from a study already included
Prediction of cardiovascular risk factors in females by serum level of triglycerides and waist circumference (Tehran Lipid and Glucose Study). Sulati SM et al. 2003	Paper published from a study already included
Obesity and cardiovascular disease risk factors in Tehran adults: a population-based study. Azizi F et al. 2004	Paper published from a study already included
Predictors of cardiovascular risk factors in Tehranian adolescents: Tehran Lipid and Glucose Study. Azizi F et al. 2004	Paper published from a study already included
Waist-to-hip ratio is a better screening measure for cardiovascular risk factors than other anthropometric indicators in Tehranian adult men. Esmailzadeh A et al. 2004	Paper published from a study already included
Blood pressure measures and electrocardiogram-defined myocardial infarction in an Iranian population: Tehran Lipid and Glucose study. Ghanbarian A et al. 2004	Paper published from a study already included

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Table 4.1 Excluded studies by title and reason of exclusion in the systematic review of the prevalence studies on risk factors of cardiovascular diseases among Iranians (continued)

Title of Study/author(s)/publication year	Reason for exclusion
Tehran (Tehran Lipid and Glucose Study)	
Dietary diversity score in adolescents - a good indicator of the nutritional adequacy of diets: Tehran lipid and glucose study. Mirmiran P et al. 2004	Paper published from a study already included
Detection of cardiovascular risk factors by anthropometric measures in Tehranian adults: receiver operating characteristic (ROC) curve analysis. Mirmiran P et al. 2004	Paper published from a study already included
Cardiovascular risk factors in males with hypertriglyceremic waist (Tehran Lipid and Glucose Study). Solati M et al. 2004	Paper published from a study already included
Dietary diversity score is favorably associated with the metabolic syndrome in Tehranian adults. Azadbakht L et al. 2005	Paper published from a study already included
General obesity and central adiposity in a representative sample of Tehranian adults: prevalence and determinants. Azadbakht L et al. 2005	Paper published from a study already included
Dairy consumption is inversely associated with the prevalence of the metabolic syndrome in Tehranian adults. Azadbakht L et al. 2005	Paper published from a study already included
Diet quality status of most Tehranian adults needs improvement. Azadbakht L et al. 2005	Paper published from a study already included
Trends in overweight, obesity and central fat accumulation among Tehranian adults between 1998-1999 and 2001-2002: Tehran lipid and glucose study. Azizi F et al. 2005	Paper published from a study already included
Is there an independent association between waist-to-hip ratio and cardiovascular risk factors in overweight and obese women? Azizi F et al. 2005	Paper published from a study already included
Correlates of under- and over-reporting of energy intake in Tehranians: body mass index and lifestyle-related factors. Azizi F et al. 2005	Paper published from a study already included
Evaluation of waist circumference to predict cardiovascular risk factors in an overweight Tehranian population: findings from Tehran Lipid and Glucose Study. Esmailzadeh A et al. 2005	Paper published from a study already included
Whole-grain consumption and the metabolic syndrome: a favorable association in Tehranian adults. Esmailzadeh A et al. 2005	Paper published from a study already included
Seasonal variation of serum lipids in adults: Tehran lipid and glucose study. Hadaegh F et al. 2005	Paper published from a study already included
Dairy consumption and body mass index: an inverse relationship. Mirmiran P et al. 2005	Paper published from a study already included
Dietary quality-adherence to the dietary guidelines in Tehranian adolescents: Tehran Lipid and Glucose Study. Mirmiran P et al. 2005	Paper published from a study already included
The relationship between glucose intolerance and blood pressure, body mass index, and waist to hip ratio in Tehran urban population: Tehran Lipid and Glucose Study. Saadat N et al. 2005	Paper published from a study already included
High prevalence of undiagnosed diabetes and abnormal glucose tolerance in the Iranian urban population: Tehran Lipid and Glucose Study. Hadaegh F et al. (2008)	Paper published from a study already included.
Food intake patterns may explain the high prevalence of cardiovascular risk factors among Iranian women. Esmailzadeh A et al. (2008)	Paper published from a study already included.
Prevalence of metabolic syndrome by the Adult Treatment Panel III, International Diabetes Federation, and World Health Organisation definitions and their association with coronary heart disease in an elderly Iranian population. Hadaegh F et al. (2009)	Paper published from a study already included.
Isfahan	
The prevalence of coronary artery disease in an urban population in Isfahan, Iran. Sarraf-Zadegan N et al. 1999	Paper published from a study already included
Lipid profiles in the Isfahan population: an Isfahan cardiovascular disease risk factor survey. 1994. Rafiei M et al. 1999	Paper published from a study already included
Prevalence of hypertension and associated risk factors in Isfahan, Islamic Republic of Iran. Sarraf-Zadegan N et al. 1999	Paper published from a study already included
Food and nutrient intake among adult of Isfahan, Iran. Mohammedifard N et al. 2000	Paper published from a study already included

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Table 4.1 Excluded studies by title and reason of exclusion in the systematic review of the prevalence studies on risk factors of cardiovascular diseases among Iranians (continued)

Title of Study/author(s)/publication year	Reason for exclusion
Isfahan	
Isfahan Healthy Heart Programme: A comprehensive integrated community-based programme for cardiovascular disease prevention and control. Design, methods and initial experience. Sarraf-Zadegan N et al. 2003	Paper published from a study already included
Tobacco use among Iranian men, women and adolescents. Sarraf-Zadegan N et al. 2004	Paper published from a study already included
High blood pressure and associated cardiovascular risk factors in Iran: Isfahan Healthy Heart Programme. Sadeghi M et al. 2004	Paper published from a study already included
The metabolic syndrome in hypertensive and normotensive subjects: The Isfahan Healthy Heart Programme. Kelishadi R et al. 2005	Paper published from a study already included
The association of leisure time physical activity, watching television, obesity and lipid profile in an Iranian population. Saidie M et al. 2005	Paper published from a study already included
Correlation of dyslipidaemia with waist to height ratio, waist circumference, and body mass index in Iranian adults. Chehrei A et al. (2007)	Sampling bias.
The relation between total daily caloric intake and blood pressure. Najafian J et al. (2008)	Paper published from a study already included.
Tehran (other studies)	
Comparative study of the effect of patient education through group discussion versus booklet on knowledge and practice of patients with hyperlipidaemia. Larijani B et al. 2003	Paper published from a study already included
Evaluation of prevalence of the metabolic syndrome in inhabitants of Tehran University of Medical Sciences Population Lab. Fakhrzadeh H et al. 2004	Paper published from a study already included
Evaluation of total plasma homocysteine, folic acid and vitamin B12 in 25-64 aged inhabitants of Tehran University of Medical Sciences population lab region. Fakhrzadeh H et al. 2004	Paper published from a study already included
The relation of hyperhomocysteinemia with impaired glucose tolerance and diabetes (The Tehran Homocysteine Survey). Fakhrzadeh H et al. 2005	Paper published from a study already included
Homocysteine levels and its correlation to metabolic syndrome in 25-64 years old residents of the Tehran medical university population lab. Fakhrzadeh H et al. 2005	Paper published from a study already included
Plasma homocysteine concentration and blood pressure in healthy Iranian adults: The Tehran homocysteine survey (2003-2004). Fakhrzadeh H et al. 2005	Paper published from a study already included
Plasma homocysteine concentration and blood pressure in healthy Iranian adults: The Tehran homocysteine survey (2003-2004). Fakhrzadeh H et al. 2005	Paper published from a study already included
Prevalence of coronary artery disease risk factors in Iran: a population based survey. Hatmi ZN et al. (2007)	Reporting quality issue.
Fars province (Shiraz)	
A study of adult height, weight and obesity in Shiraz, Iran. Ayatollahi SMT et al. 1992	Usable information was not provided.
Height, weight, BMI and weight-for-height of adults in southern Iran: how should obesity be defined? Ayatollahi SMT et al. 1993	Usable information was not provided.
Ahwaz	
Eating patterns and prevalence of obesity among Arabs living in Ahwaz, Iran. Soori et al. 2002	Paper published from a study already included

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Table 4.1 Excluded studies by title and reason of exclusion in the systematic review of the prevalence studies on risk factors of cardiovascular diseases among Iranians (continued)

Title of Study/author(s)/publication year	Reason for exclusion
Golestan province	
Obesity and hypertension in an Iranian cohort study; Iranian women experience higher rates of obesity and hypertension than American women. Bahrami H et al. (2006)	Usable information was not provided.
Rasht	
Association of gender and education with blood lipids and fasting glucose levels in a sample of Iranian obese adults. Maddah M (2007)	Is not a population based study.
Semnan	
Prevalence of hypertension among the adult population of Semnan province Ghorbani et al. (2009)	Paper published from a study already included
Tabriz	
Prevalence of obesity, food choices and socio-economic status: a cross-sectional study in the north-west of Iran. Dastgiri S et al. (2006)	Usable information was not provided.
National studies	
Prevalence of diabetes mellitus in Iran in 2000. Larijani B et al. 2005	Usable information were not provided
Prevalence of obesity in Iran. Rashidi A et al. 2005	Narrative description of findings from published and unpublished national and local studies without quoting to their methodology
Epidemiology and heterogeneity of hypertension in Iran: a systematic review. Haghdoust AA et al. (2008)	Methodological and reporting quality issue.
Nationwide survey of prevalence and risk factors of pre-hypertension and hypertension in Iranian adults. Janghorbani M et al. (2009)	Paper published from a study already included.
Studies on Iranians abroad	
Morbidity in cardiovascular diseases in immigrants in Sweden. Gadd M et al. 2003	Usable information were not provided
Dietary fat intake, fat sources and fatty acid composition in serum among immigrant women from Iran and Turkey compared with women of Swedish ethnicity. Daryani A et al. 2005	Paper published from a study already included
The trend of cardiovascular disease in immigrants in Sweden. Gadd M et al. 2005	Usable information were not provided
Immigrants from the Middle-East have a different form of Type 2 diabetes compared with Swedish patients. Glans F et al. (2008)	Is not a population based study.
Is migration to Sweden associated with increased prevalence of risk factors for cardiovascular disease? Koochek A et al. (2008)	Is not a population based study.
Physical activity and body mass index in elderly Iranians in Sweden: a population-based study. Koochek A et al. (2008)	Is not a population based study.

Table 4.2 Quality assessment of the included studies in the systematic review of the prevalence studies on risk factors of cardiovascular diseases among Iranians

Study	Internal Validity					External Validity		Reporting quality		Overall assessment of quality**
	Performance Variables direct observation	Control of Confounding				Representative sample	Participation rate (≥80%)	PR * with (95% CI)	Age/sex adjusted PR	
		Age	Sex	Education	Occupation					
Studies in Iran										
Azizi F et al (416)	✓	✓	✓	NA ^a	NA	✓	✓	✓	✓	A
Amini M et al. (453)	✓	✓	✓	NA	NA	✓	✓	✓	✓	A
Sarraf-Zadegan N et al. (454)	✓	✓	✓	NA	NA	✓	✓	✓	NP ^β	B
Sarraf-Zadegan N et al. (456)	✓	✓	✓	NA	NA	✓	NM ⁷	NP	NP	C
Sadeghi K et al. (459)	✓	✓	✓	NA	NA	✓	✓	NP	NP	B
Roohafza H et al. (466)	✓	✓	✓	✓	NA	✓	NM	NP	NP	C
Kelishadi R et al. (468)	✓	✓	✓	NA	NA	✓	✓	NP	✓	B
Sarraf-Zadegan N et al. (469)	✓	✓	✓	NA	NA	✓	NP	NP	NP	C
Fakhrazadeh H et al. (471)	✓	✓	✓	NA	NA	✓	✓	✓	✓	A
Soori H et al. (478)	NM	✓	✓	NA	NA	✓	✓	✓	✓	C
Pishdad G R (482)	✓	✓	✓	NA	NA	✓	NP	NP	NP	C
Ahmadi J et al. (483)	✓	✓	✓	NP	NP	✓	✓	NP	NP	B
Mostafavi H et al. (484)	✓	✓	✓	NA	NA	✓	NP	NP	NP	C
Sotoudeh G et al. (485)	✓	✓	NA	✓	✓	✓	✓	NP	✓	B
Nadimi A.E (486)	✓	✓	✓	NA	NA	✓	✓	NP	NP	C
Larjani B et al. (487)	✓	✓	✓	NA	NA	✓	✓	✓	✓	B
Azimi-Nezhad M et al. (488)	✓	✓	✓	✓	✓	✓	NP	NP	NP	C
Rashidy-Pour A et al. (489)	✓	✓	✓	✓	NA	✓	NP	NP	NP	C
Kimiagar SM et al. (490)	✓	NP	✓	NA	NA	✓	NP	NP	NP	C
Azizi F et al. (491)	✓	✓	✓	NA	NA	NP	NP	NP	NP	C
Mosavi-Jarrahi A et al. (492)	✓	✓	✓	NA	NA	✓	✓	NP	✓	B
Mohammad K et al. (493)	✓	✓	✓	NA	NA	✓	✓	NP	NP	B
Janghorbani M et al. (496)	✓	✓	✓	✓	NP	✓	NP	✓	✓	B
Esteghamati A et al. (497)	✓	✓	✓	NA	NA	✓	NM	✓	✓	B
Esteghamati A et al. (499)	✓	✓	✓	NA	NA	✓	✓	✓	✓	A
Studies on Iranians abroad										
Rissel C et al. (305)	NM	✓	✓	NA	NA	✓	✓	NP	NP	C
Glenday K et al. (391)	✓	✓	✓	NA	NA	✓	NM	NP	✓	B
Daryani A et al. (509)	✓	✓	NA	✓	✓	✓	NM	NP	✓	B

* Prevalence Rate
** A: All internal and external validity criteria were met; B: One major issue in the internal or external validity; C: More than one major issue in the internal or external validity
† Not applicable: the author(s) did not include the variable in the study β Not provided: the author(s) included the variable in the study but not explained results based on the variable γ Not met: the pre-defined quality criteria not met in the study

391, 416, 453, 454, 456, 459, 466, 468, 471, 478, 483, 493, 497, 499, 509) participation rate as a criteria of external validity was reported. The rate in five articles (391, 456, 466, 497, 509) was below 80% and therefore they were liable to selection bias; however, only in one of the related studies (454) non-participants were surveyed to ensure that comparable differences do not exist between them and those who consented to participate.

As an index of reporting quality only in nine articles (416, 453, 471, 478, 487, 492, 496, 497, 499) prevalence rate estimates of CVD risk factors were given with their precision (e.g. 95% confidence interval). Adjusted prevalence rates for major confounding factors (e.g. age) as another criterion of reporting quality were provided in 11 articles. (387, 391, 416, 453, 468, 471, 485, 496, 497, 499, 509) Thus only in four studies (416, 453, 471, 499) all intended criteria for internal and external validity were met. The overall quality of included studies was highly variable. Different methods, instruments or cut-off points were used in the most of the retrieved articles in relation to CVD risk factors (the applied methods and cut off points were shown separately for each of the CVD risk factors as follow). In order to assess these divergences statistically and to investigate heterogeneity among the studies the Q test was performed (as stated earlier it is the test of dispersion among studies).

In some cases (471, 492), the authors were contacted to get clarification about mismatches in the data within the articles or to get additional data to be able to calculate adjusted prevalence rates. These contacts, however, were not added to the extracted data from the included studies since corresponding author of one article (471) did not respond and of the second article has confirmed typo in a part of the article. (492)

4.3.2 Prevalence of CVD risk factors in Iran

4.3.2.1 Physical inactivity

Only in four articles (456, 459, 496, 509) data were provided about physical inactivity (Table 4.3). In none of the four corresponding studies application of a standard measurement protocol was mentioned. Only in one of the included articles (456) raw data were provided so that a researcher can calculate age standardised prevalence rates.

In this article subjects who did not exercise at all were classified as physically inactive. One of the Iranian publications (459) neither provided age adjusted prevalence rate of physical inactivity nor the needed raw data a researcher can calculate it. In the study by Janghorbani et al. (496) people who have reported to do physical activity at least 30 minutes a week were labelled in the group with regular physical activity level. Daryani et al. (509) in their study on the Iranian women in Sweden have not provided any information about their applied definition of low physical activity. With this background calculation of an overall summary estimate for prevalence of physical activity/inactivity in the Iranian migrant or indigenous population was not possible.

Table 4.3 Reported prevalence rate of physical inactivity in the studies on Iranian indigenous and migrant population.

Study/age group/ fieldwork or publication date	Men	Women
	Prevalence % (95% CI)	Prevalence % (95% CI)
Studies in Iran		
Sadeghi K et al./ > 15 years 1995 (459)	22.1 (19.3-25.1) *	32.4 (29.1-35.9) *
Sarraf-Zadegan N et al./ 19-70 years 1999 (456)	71.5 (71.1-71.8) **	89.3 (89.0-89.8) **
Janghorbani M et al./ 25-64 years 2004-05 (496)	64.6 (64.2-65.0) * ^β	79.7 (79.3-80.1) * ^β
Studies on Iranians abroad		
Daryani A et al./ 35-64 years 1995-96 (509)	NA ^γ	49.3% (95% CI: 38-60.7) *

* Confidence interval was calculated by the author

** Age-standardised rate: standardised to latest Iranian population census data by the author

^β Age-adjusted rate

^γ Not applicable

4.3.2.2 Smoking

Ten publications (305, 391, 416, 456, 466, 471, 483, 484, 496, 509) reported data on cigarette smoking (Table 4.4). Self reported smoking was used in all of the studies to determine smoking status. Three reports representing studies among Iranians in Norway,

Table 4.4 Crude (CPR %) and age standardised prevalence rate (SPR %) of smoking by sex in the selected studies of Iranian indigenous and migrant adult population.

Study/age group	Measurement method	Cut off point	Male CPR (95% CI) SPR (95% CI)	Female CPR (95% CI) SPR (95% CI)
Studies in Iran				
Roohafza H et al. (466) ≥ 20 years old (Isfahan-1993 to 1994)	Self reported	At least one cigarette a day	29.0 (27.8-30.3) *	1.6 (1.3-2) *
Mosavi-Jarrahi A et al. (492) > 15 years old (National-1989 and 1999)	Self reported	At least one cigarette a day	NC **	NC
Sarraf-Zadegan N et al. (456) 20-70 years old (Isfahan-published in 1999)	Self reported	At least one cigarette a day	23.7 (23.2-24.1) *	1.7 (1.6-1.9) *
			23.1 (22.5-23.8) ***	1.6 (1.4-1.8) ***
			23.7 (22.0-25.5) *	0.9 (0.6-1.3) *
			22.8 (20.3-25.5) ***	0.5 (0.2-1.1) ***
Azizi et al (416) ≥ 20 years old (Tehran- 1999 to 2001)	Self reported	At least one cigarette a day	22.3 (21.1-23.5) ^a	2.1 (1.8-2.4) ^a
Ahmadi J et al. (483) > 15 years old (Shiraz-published in 2001)	Self reported	At least one cigarette a day	10.0 (9.2-10.9) ***	1.8 (1.5-2.2) ***
			26.2 (23.3-29.4) ^β	3.6 (2.4-5.5) ^β
Fakhrzadeh H et al (471) 25-64 years old (Tehran-2002)	Self reported	At least one cigarette a day	NC	NC
			23.5 (20.2-27.0) ^a	1.8 (1.1-2.9) ^a
Janghorbani M et al. (496) 24-65 years old (National- 2004-05)	Self reported	At least one cigarette a day	NC	NC
			28.1 (27.7-28.5) ^a	5.8 (5.6-6.0) ^a
			NC	NC
Studies on Iranians abroad				
Rissel C et al. (305) >18 years old (Australia- published 1997)	Self reported	NE ^λ	23.9 (18.7-29.9) ^β	17.0 (12.3-23.0) ^β
			NC	NC

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Table 4.4 Crude (CPR %) and age standardised prevalence rate (SPR %) of smoking by sex in the selected studies of Iranian indigenous and migrant adult population (continued).

Study/age group	Measurement method	Cut off point	Male CPR (95% CI) SPR (95% CI)	Female CPR (95% CI) SPR (95% CI)
Studies on Iranians abroad				
Daryani A et al. (509) Women aged 35-64 (Sweden- 1998-2000)	Self reported	NE	NA ^δ	21.0 (13.2-32.0) ^α
Glenday K et al. (391) 31-60 (Norway-2002)	NE	NE	NC 11.2 (8.3-14.9) ^α	NC 10.5 (7.2-15.1) ^α

* Age adjusted prevalence rate and its confidence interval calculated by the author.

** Not Calculable: raw data were not provided in the article to be able to calculate age standardised prevalence rate.

*** The prevalence rate standardised according to the latest Iranian population census data.

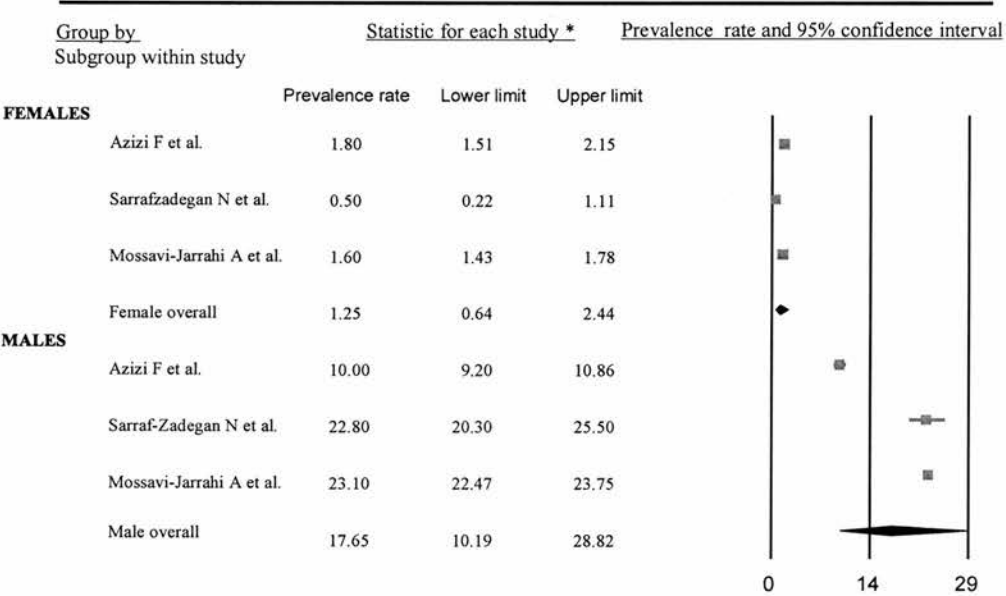
^α The confidence interval calculated by the author.

^β It was not possible to calculate age adjusted prevalence rate due to lack of data in the main article.

^λ Not explained. ^δ Not applicable.

(391) Australia (305) and Sweden (509) had information about smoking. In the Iranian publications data to calculate standardised prevalence rates were provided in only three articles. (416, 456, 484) As a result, estimation of an overall smoking rate among Iranians was performed using the findings of these three studies. In the article of Glenday et al (391) and Rissel et al. (305) necessary data to calculate age adjusted smoking prevalence rates were not provided. The study by Daryani et al. (509) was conducted solely on the Iranian migrant women living in Sweden. Thus, due to all these limitations calculation of an overall smoking prevalence rate for Iranian male and female migrants was not possible.

Analysis of the included publications has shown heterogeneity among articles that reported the prevalence of smoking rate in the Iranian adult male ($P < 0.000$ and $I^2 = 99.49$) and female populations ($P = 0.007$ and $I^2 = 79.65$). Therefore random effects model was used to calculate overall prevalence estimate of smoking rate based on the reported findings in the included papers. (Figure 4.2)



* Since entered prevalence rates automatically rounded up by the CMA software to calculate the confidence interval limits you may notice their very small differences with the given limits in the summary tables.

Figure 4.2 Overall pooled estimates from the standardised prevalence rates of smoking in studies on the Iranian adult population.

The calculated point estimates of the prevalence of daily cigarette smoking shows a considerable difference between Iranian men and women. The age standardised self-reported smoking rate was considerably lower in the study of Sarraf-Zadegan et al. (456) among females and in the study of Azizi et al. (416) among males. This caused a wider confidence interval for the overall point estimates especially in the male subgroup. Findings of studies on Iranians abroad have shown a higher rate of smoking among Iranian women compared to the Iranian indigenous women. As a result the observed gap in the Iranian studies regarding the self reported smoking rate between men and women seems to be narrower in the Iranian migrants.

4.3.2.3 Hypertension

The prevalence of hypertension or weighted mean level of systolic (SBP) and diastolic (DBP) blood pressure of Iranian indigenous adult population (416, 453, 454, 456, 466, 469, 471, 493, 496, 499) or Iranian migrants (391, 509) were reported in 12 articles (Table 4.5). A considerable heterogeneity was seen in the blood pressure measurement methods of the included studies. Among the seven publications reporting the prevalence of hypertension in Iran only in three articles (416, 471, 501) age standardised prevalence rates or raw data to be calculated by other researchers were provided. Only in the article of Esteghamati et al. (501) the standardised prevalence rates were provided based on the Iranian standard population. Therefore, only reported or calculated standardised prevalence rates of hypertension in these eligible articles were used to estimate an overall prevalence rate for Iranian indigenous males and females.

In the article of Sarraf-Zadegan et al. (456) detailed data about the prevalence of hypertension in different age groups were only given using a higher cut off points for SBP and DBP (hypertension was defined as having $SBP \geq 160$ mmHg or $DBP \geq 95$ mmHg or using anti-hypertensive medication). In most of the other papers (391, 416, 454, 465, 466, 471, 501); however, WHO criteria ($SBP \geq 140$ mmHg or $DBP \geq 90$ mmHg or using anti-hypertensive medication) were applied.

Due to the heterogeneity observed among the included studies random effects model was used to calculate the point estimates of the mean SBP and DBP levels according to the reported weighted means in the four eligible papers (Table 4.6).

Table 4.5 Crude (PR%) and age standardised prevalence rate (SPR%) of hypertension by sex in the selected studies of Iranian indigenous and migrant adult population.

Study/age group/ fieldwork or publication date	Measurement method	Cut off point	Male (PR, 95% CI) SPR (95% CI)	Female (PR, 95%CI) SPR (95% CI)
Studies in Iran				
Amini M et al. (453)/ Age group ≥ 40 years (Isfahan-1993)	Mean of three measurements (in seating position and on three different occasions after a 10 minutes rest).	SBP> 160 mmHg or DBP< 90 mmHg or past history of hypertension (In non diabetic/IGT population)	NP [*]	NP [*]
Sarraf-Zadegan N et al. (454)/ 19-70 years old (Isfahan-1993 to 1994)	Mean of three measurements (in seating position and on the right arm using a standard mercury sphygmomanometer) (first measurement after 5 minutes rest in sitting position) /Those with SBP≥140 or DBP≥ 90 mmHg were re-measured by another observer.	SBP≥ 140 mmHg or DBP≥ 90 mmHg or using anti-hypertensive medication	24.0 (22.9-25.1)	29 (27.9-30.2)
Roohafza H et al. (466)/ ≥ 20 years old (Isfahan-1993 to 1994)	Mean of three consecutive measurements in sitting position (first measurement after 10 minutes rest).	SBP> 140 mmHg or DBP> 90 mmHg or using anti-hypertensive medication	NC	NC
Sarraf-Zadegan N et al. (456)/ 20-70 years old (Isfahan- published in 1999)	Mean value of the three consecutive measurements (in seating position and on the right arm using a standard mercury sphygmomanometer) with 5 minutes interval (first measurement after 5 minutes rest in sitting position).	SBP≥ 160 mmHg or DBP≥ 95 mmHg or using anti-hypertensive medication	15.6 (14.6-16.6)	18.8 (17.7-20.0)
Azizi et al. (416)/ Age group ≥ 20 years (Tehran- 1999 to 2001)	Mean of two measurements (in seating position and on the right arm using a standard mercury sphygmomanometer) with at least 30 second interval (first measurement after 15 minutes rest in sitting position).	SBP≥ 140 mmHg or DBP ≥ 90 mmHg or using anti-hypertensive medication	NC	NC
Mohammad,K et al. (493)/ > 25 years old (National-2001)	NE λ	NE	20.9 (19.3-22.7) ^a	29.0 (27.1-30.9) ^a
Sarraf-Zadegan N et al. (469)/ ≥ 19 years/ Isfahan (Isfahan-2000-2001)	Mean of two BP measurements in seating position.	NE	NC	NC
Fakhrzadeh H et al. (471)/ Age group 25-64 years (Tehran-2002)	Mean of two measurements (in seating position and on the right arm using a standard mercury sphygmomanometer and after 10 minutes rest each time) (JNC VII criteria).	SBP≥ 140 mmHg or DBP≥ 90	20.4 (19.2-21.6)	25.1 (24.0-26.2)
Janghorbani M et al. (496)/ > 25 years old (National-2004-05)	Mean of two blood pressure measurements (on the right arm using a standard mercury sphygmomanometer) after a 15 minutes rest with a 30 second interval between measurements.	NE	14.0 (13.0-15.1) ^β	13.7 (12.8-14.7) ^β
Esteghamati A et al. (499)/ 25-64 years/National/ Jan-Feb 2005	Mean of two measurements (in seating position and on the right arm using a standard mercury sphygmomanometer) after a 10 minutes rest.	SBP ^ε ≥ 140 mmHg or DBP ^ε ≥ 90 mmHg or using anti-hypertensive medication	13.9 ^δ	22.1 ^δ
			NC	NC
			NP	NP
			NC	NC
			41.7 (39.3-44.1)	37.6 (35.2-40.0)
			41.5 (37.7-45.4) ^β	37.5 (34.4-40.5) ^β
			NP	NP
			NC	NC
			NE	NE
			25.5 (25.0-26.0)	24.8 (24.3-25.3)

Table continued on next page

Table 4.5 Crude (PR%) and age standardised prevalence rate (SPR%) of hypertension by sex in the selected studies of Iranian indigenous and migrant adult population (continued).

Study/age group/ fieldwork or publication date	Measurement method	Cut off point	Male		Female	
			(PR, 95% CI) SPR (95% CI)	(PR, 95% CI) SPR (95% CI)	(PR, 95% CI) SPR (95% CI)	(PR, 95% CI) SPR (95% CI)
Studies on Iranians abroad						
Daryani A et al. (320)/ Women aged 35-64 (Sweden- 1998-2000)	Blood pressure was measured in the right arm after 5 minutes resting in supine position using a standard mercury sphygmomanometer.	SBP≥ 130 mmHg or DBP≥ 85	NA ^ε		6.0 (2.2-13.6) ^ε	
Glenday K et al. (391)/ 31-60 (Norway-2002)	Mean value of the 2 nd and 3 rd measurements from three consecutive measurements at 1 minute intervals/An automatic device was used for BP measurement.	SBP≥ 140 mmHg or DBP≥ 90 mmHg or using anti-hypertensive medication	14.0 (10.8-17.9) ^ε		10.9 (7.6-15.5) ^ε	
			NC		NC	

* Not Provided: only mean systolic and diastolic blood pressure were reported.

** Not calculable: raw data were not provided in the article to be able to calculate age standardised prevalence rate.

α Age adjusted prevalence rate and its confidence interval calculated by the author.

β Age standardised prevalence rate and the confidence interval calculated by the authors using the latest Iranian population census data.

λ Not explained in the article.

δ It was not possible to calculate confidence interval due to lack of data in the main article.

€ Not applicable

ϕ Confidence interval calculated by the author.

Since a recent article of Sarraf-Zadegan et al. (469) was based an updated analysis of the data published earlier by the author and her colleagues (456) it was decided to use the information in the recent publications. In order to prevent bias in the calculation of the overall point estimates the reported findings of the study of Amini et al. (453) also were excluded due to their focus on people from ≥ 40 age group. With the same token the study of Sarraf-Zadegan et al. (454) was excluded due to their fieldwork date (which was in 1993-1994) and inclusion of an updated study from Isfahan. (469)

Table 4.6 Overall pooled estimate of the mean systolic (SBP) and diastolic (DBP) blood pressure (mmHg) based on the reported weighted means in the included studies on Iranian indigenous adult population.

Study	Mean SBP (95% CI)	Mean DBP (95% CI)
Amini M et al. (453)		
Male	132.65 (132.52-132.79) *	82.28 (82.23-82.33) *
Female	133.95 (133.83-134.10) *	82.32 (82.26-82.38) *
Sarraf-Zadegan N et al. (454)		
Male	131.83 (131.49-132.17) *	83.78 (83.60-83.96) *
Female	132.20 (131.75-132.65) *	82.88 (82.63-83.13) *
Azizi F et al. (416)		
Male	119.48 (118.95-120.01)	77.40 (77.07-77.73)
Female	116.12 (115.70-116.57)	76.90 (76.63-77.17)
Sarraf-Zadegan N et al. (469)		
Male	115.30 (114.71-115.89) *	75.40 (75.01-75.79) *
Female	114.60 (114.01-115.19) *	75.20 (74.81-75.59) *
Fakhrzadeh H et al. (471)		
Male	128.00 (126.41-129.58)	84.00 (82.97-85.03)
Female	127.00 (125.48-128.52)	83.00 (82.11-83.89)
Janghorbani M et al. (496)		
Male	123.30 (123.14-123.46) *	78.40 (78.28-78.52) *
Female	121.30 (121.14-121.46) *	76.50 (76.38-76.62) *
Overall point estimate **		
Male	121.47 (117.39-125.55)	78.68 (77.13-80.24)
Female	119.70 (115.62-123.79)	77.81 (76.26-79.37)
Test of heterogeneity results		
Male	$I^2=99.65$, $P<0.000$	$I^2=99.14$, $P<0.000$
Female	$I^2=99.67$, $P<0.000$	$I^2=98.83$, $P<0.000$

* Confidence interval calculated by the author.

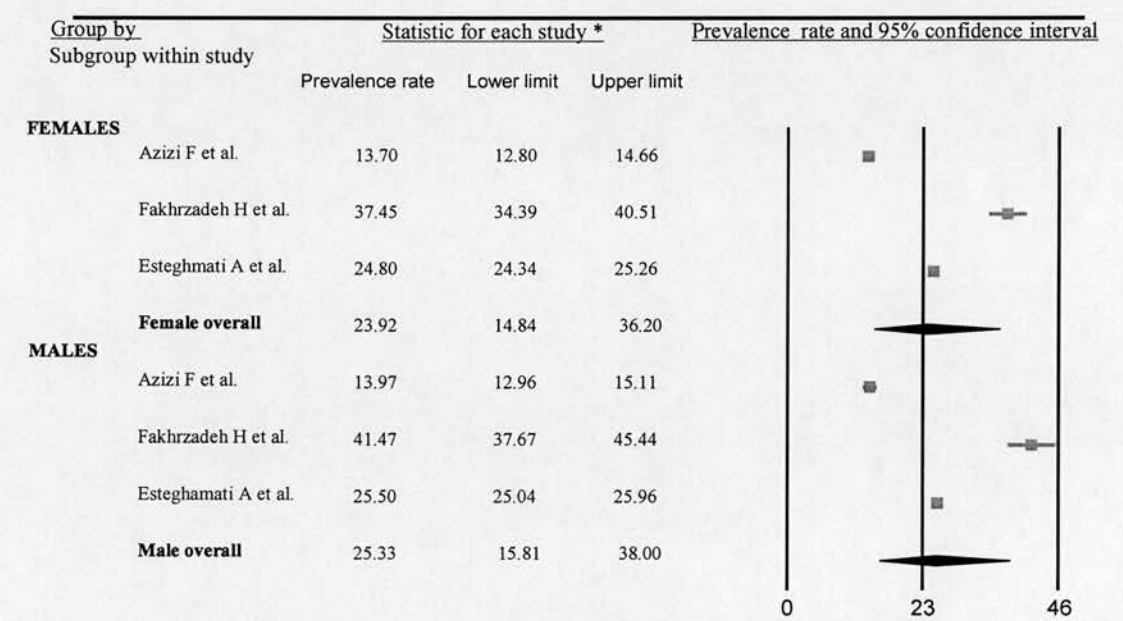
** Excluding findings of the studies of Amini M et al. (453) and Sarraf-Zadegan N et al. (454)

Pooled point estimate of the prevalence of hypertension was shown in Figure 4.3. Random effects model has been used in both subgroups ($P< 0.000$, $I^2= 99.50$ in female and $P< 0.000$, $I^2= 99.41$ in the male subgroup of studies) to calculate the overall rates due to the observed heterogeneity among the included studies. Major disparity was seen regarding the reported prevalence rate of hypertension among the studies in both sexes.

For instance studies of Azizi et al. (416) and Fakhrzadeh et al. (471) both were conducted on a randomly selected sample of adults in almost same age groups (but in different regions) in Tehran but their findings are extremely different. A lower prevalence of hypertension among Iranian males and females in Norway (391) and also very lower prevalence rate of hypertension among Iranian women in Sweden (320) (while using a lower cut off points) all needs to be clarified.

4.3.2.4 Overweight and obesity

Being overweight as a risk factor for CVD based on the calculated BMI was reported in 11 publications (305, 391, 416, 453, 466, 471, 478, 482, 484, 485, 489) as indicated in Table 4.7.



* Since entered prevalence rates automatically rounded up by the CMA software to calculate the confidence interval limits you may notice their very small differences with the given limits in the summary tables.

Figure 4.3 Overall pooled estimates from the standardised prevalence rates of hypertension in studies on the Iranian adult population.

Also from 28 included articles in this systematic review, 10 reports had data about the prevalence of obesity in the Iranian population or Iranian ethnic minorities living abroad (Table 4.8). (416, 453, 456, 471, 478, 482, 484, 485, 489, 509)

Table 4.7 Crude (PR) and age standardised prevalence rate (SPR) of overweight by sex in the selected studies of Iranian indigenous and migrant adult population.

Study/age group/ location/fieldwork or publication date	Measurement method	Cut off point	Male PR (95%CI) SPR (95% CI)	Female PR (95%CI) SPR (95% CI)
Studies in Iran				
Amini M et al (453) Age group ≥ 40 years (Isfahan-1993)	Measurements were taken with shoes removed and the participants light clothing. The protocol for height and weight measurements was not specified.	25 ≤ BMI < 30 kg/m ² (In non IGT/ diabetic people)	NP [*]	NP
Roozafza H et al. (466) ≥ 20 years old (Isfahan-1993 to 1994)	Measurements were taken with shoes removed and the participants light clothing. The protocol for height and weight measurements was not specified.	25 ≤ BMI < 30 kg/m ²	NC ^{**}	NC ^{**}
Pishdad G R (482) 20-74 years old (Fars- 1993-94)	Weight measurements were taken with light clothing. The protocol for height and weight measurements was not specified.	25 ≤ BMI ≤ 30 kg/m ²	NC	NC
Azizi et al (416) Age group ≥ 20 years (Tehran- 1999 to 2001)	Measurements were taken with shoes removed and the participants light clothing. The protocol for height and weight measurements was not specified.	25 ≤ BMI < 30 kg/m ²	25.4 (23.9-26.9) ^β	30.0 (28.5-31.6) ^β
Soori H et al. (478) 18-84 years old (Ahwaz- published in 2001)	Self reported height and weight was used to calculate BMI.	25 ≤ BMI < 30 kg/m ²	25.7 (23.7-27.8) ^λ	30.3 (28.1-32.6) ^λ
Mostafavi H et al. (484) ≥ 19 years old (Shiraz-2001-2002)	Weight measurements were taken with light clothing. The protocol for height and weight measurements was not specified.	25 ≤ BMI ≤ 29 kg/m ² for men and 24 ≤ BMI ≤ 27 kg/m ² for women	42.5 (41.0-44.0)	38.1 (36.9-39.3)
Fakhrzadeh H et al (471) Age group 25-64 years (Tehran-2002)	Measurements were taken with shoes removed and the participants light clothing. The protocol for height and weight measurements was not specified.	25 ≤ BMI < 30 kg/m ²	39.21 (37.8-40.7) ^λ	36.45 (35.3-37.7) ^λ
Sotoudeh G et al. (485) 10-65 years old women (Islamshahr-2003)	Measurements were taken with shoes removed and the participants light clothing (1 kg subtracted to correct for the weight of clothing). The protocol for height and weight measurements was not specified.	25 ≤ BMI < 30 kg/m ²	38.4 (35.3-41.6) ^{αδ}	34.15 (24.8-44.9) ^{αδ}
Rashidi-Pour A et al. (489) 30-70 years Semnan-Oct 2005 to Feb 2006	Weight measurements were taken with light clothing and shoes removed. Standing height was measured by a tape measure. The protocol for height and weight measurements was not specified.	25 ≤ BMI < 30	NC	NC
			28.2 (26.7-29.8) ^β	NP
			25.2 (22.9-27.7) ^λ	NC
			42.3 (39.8-44.8) ^α	36.3 (34.7-39.9) ^α
			NC	NC
			NA ^ε	33.7 (30.3-37.3) ^δ
				25.6 (22.6-28.9)
			43.48 (41.41-45.63)	38.32 (36.38-40.35)
			43.14 (40.80-45.51) ^λ	38.10 (36.05-40.20) ^λ

Table continued on next page

Table 4.7 Crude (PR) and age standardised prevalence rate (SPR) of overweight by sex in the selected studies of Iranian indigenous and migrant adult population (continued).

Study/age group/ location/fieldwork or publication date	Measurement method	Cut off point	Male		Female	
			PR (95 %CI) SPR (95% CI)	PR (95%CI) SPR (95% CI)		
Studies on Iranians abroad						
Rissel C et al. (305) >18 years old (Australia- published 1997)	Self reported height and weight was used to calculate BMI.	BMI ≥ 25 kg/m ²	36.0 (30-42.5) ^a	29.3 (23.2-36.1) ^a		
Glenday K et al. (391) 31-60 years old (Norway-2002)	Body weight and height was measured with electronic Height and Weight Scale with the participants wearing light clothing without shoes.	BMI ≥ 25 kg/m ²	NC	NC		
			71.0 (62.5-80.2) ^{δ ε}	58.8 (49.5-69.4) ^{δ ε}		
			NC	NC		

* Not Provided: only mean BMI was provided.

** Not calculable: raw data were not provided in the article to be able to calculate age standardised prevalence rate.

^a It was not possible to calculate age adjusted prevalence rate due to lack of data in the main article.

^b Age adjusted prevalence rate and its confidence interval calculated by the author.

^λ Standardised prevalence rate and its confidence interval calculated by the author.

^δ Confidence interval calculated by the author.

^ε Reported rate in this article shows the prevalence of overweight and obesity together.

Table 4.8 Crude (PR) and age standardised prevalence rate (SPR) of obesity by sex in the selected studies of Iranian indigenous and migrant adult population.

Study/age group/ location/fieldwork or publication date	Measurement method	Cut off point	Male PR(95% CI) SPR [†] (95% CI)	Female PR(95% CI) SPR (95% CI)
Studies in Iran				
Amini M et al. (453) Age group ≥ 40 years (Isfahan-1993)	Measurements were taken with shoes removed and the participants light clothing. The protocol for height and weight measurements were not specified	BMI ≥ 30 kg/m ² (In non-diabetic /IGT population)	NP [*]	NP
Pishdad G R (482) 20-74 years old (Fars-1993-94)	Weight measurements were taken with light clothing. The protocol for height and weight measurements was not specified	BMI ≥ 30 kg/m ²	NC ^{**}	NC
Sarraf-Zadegan N et al. (456) 20-70 years old (Isfahan-published in 1999)	Measurements were taken with shoes removed and the participants light clothing according to the WHO criteria.	BMI ≥ 30 kg/m ²	2.5 (2.0-3.1) ^α 2.6 (2.0-3.5) ^β 7.9 (6.8-9.1)	7.8 (7.0-8.8) ^α 8.0 (6.8-9.4) ^β 21.8 (20.1-23.5)
Azizi et al. (416) Age group ≥ 20 years (Tehran- 1999 to 2001)	Measurements were taken with shoes removed and the participants light clothing. The protocol for height and weight measurements was not specified.	BMI ≥ 30 kg/m ²	NC	NC
Soori H et al. (478) 18-84 years old (Ahwaz- published in 2001)	Self reported height and weight was used to calculate BMI.	BMI > 30 kg/m ² for men and BMI > 28 kg/m ² for women	14.4 (13.4-15.4) 13.3 (12.3-14.4) ^β 11.9 (9.9-14.2) ^{λ,δ}	29.5 (28.3-30.7) 25.5 (24.4-26.6) ^β 36.6 (27.0-47.4) ^{λ,δ}
Mostafavi H et al. (484) ≥ 19 years old (Shiraz-2001-2002)	Weight measurements were taken with light clothing. The protocol for height and weight measurements was not specified.	BMI ≥ 30 kg/m ²	NC	NC
Fakhrzadeh H et al. (471) Age group 25-64 years (Tehran-2002)	Measurements were taken with shoes removed and the participants light clothing. The protocol for height and weight measurements was not specified.	BMI ≥ 30 kg/m ²	7.12 (6.3-8.1) ^α 6.3 (5.1-7.8) ^β 18.6 (16.7-20.5)	NP NC 38.3 (35.9-40.7)
Sotoudeh G et al. (485) 10-65 years old women (Islamshahr-2003)	Measurements were taken with shoes removed and the participants light clothing (1 kg subtracted to correct for the weight of clothing). The protocol for height and weight measurements was not specified.	BMI > 30 kg/m ² for men and BMI > 28 kg/m ² for women	NC	NC
Rashidi-Pour A et al. (489) 30-70 years Semnan-Oct 2005 to Feb 2006	Weight measurements were taken with light clothing and shoes removed. Standing height was measured by a tape measure. The protocol for height and weight measurements was not specified.	BMI ≥ 30 kg/m ²	NA ^ε 14.4 (13.2-15.7) ^δ 14.2 (12.6-15.9) ^β	34.59 (31.1-38.2) ^δ 30.3 (27.1-33.7) ^β 35.8 (33.9-37.7) ^δ 35.8 (33.7-37.8) ^β

Table continued on next page

Table 4.8 Crude (PR) and age standardised prevalence rate (SPR) of obesity by sex in the selected studies of Iranian indigenous and migrant adult population (continued).

Study/age group/ location/fieldwork or publication date	Measurement method	Cut off point	Male		Female	
			PR(95% CI)	SPR [†] (95% CI)	PR(95% CI)	SPR [†] (95% CI)
			Studies on Iranians abroad			
Daryani A et al. (320) Women aged 35-64 (Sweden- 1998-2000)	Measurements were taken with shoes removed and the participants light clothing (height was measured to nearest 0.5 cm and the weight to the nearest 0.1 kg on a digital scale). The protocol for height and weight measurements were not specified	BMI≥30 kg/m ²	NA		13.0 (6.8-22.4)	^δ

* Not Provided: only mean BMI was provided.

** Not calculable: raw data were not provided in the article to be able to calculate age standardised prevalence rate.

α Age adjusted prevalence rate and its confidence interval calculated by the author.

β Standardised prevalence rate and its confidence interval calculated by the author.

λ It was not possible to calculate age adjusted prevalence rate due to lack of data in the main article.

δ Confidence interval calculated by the author.

¶ Not applicable.

Among these included articles self reported weight and height had been used in two reports (305, 478) to calculate BMI. In some of the Iranian publications (453, 456, 466, 471, 491) age-adjusted prevalence rates or/and needed data to be able to calculate standardised prevalence rates were not provided. In the article published by Mostafavi et al. (484) the provided data were only applicable to calculate standardised prevalence rate in the Iranian men. Another included paper (485) was only about a group of Iranian women. Thus for the purpose of this systematic review the data from only five articles (416, 482, 484, 485, 489) were applied to calculate separately the overall point estimates of the prevalence of overweight and obesity in the Iranian population. Moreover, the data about sex specific weighted mean level of BMI which were provided in six articles have been applied to calculate pooled point estimate of the mean BMI in the Iranian population (Table 4.9).

Table 4.9 Overall pooled estimate of the mean body mass index (BMI) based on the reported weighted means in the included studies on Iranian indigenous adult population.

Study	Male (95% CI)	Female (95% CI)
Amini M et al. (453)	25.72 (25.62-25.82) *	26.36 (26.27-26.45) *
Pishdad GR (482)	22.8 (22.6-23.0) *	23.6 (23.3-23.9) *
Sarraf-Zadegan N et al. (456)	24.8 (24.6-25.0) *	27.0 (26.8-27.3) *
Azizi F et al. (416)	25.7 (25.6-25.8)	27.5 (27.4-27.6)
Kelishadi R et al. (468)	25.4 (25.3-25.4) *	27.4 (27.3-27.5) *
Mostafavi H et al. (484)	23.8 (23.6-24.0) *	25.3 (25.2-25.4) *
Fakhrzadeh H et al. (471)	26.0 (25.6-26.4) *	29.0 (28.6-29.4) *
Sotoudeh G et al. (485)	NA ^α	27.5 (27.4-27.6)
Janghorbani M et al. (496)	24.6 (24.56-24.64) *	26.5 (26.46-26.54) *
Overall point estimate ^β	25.0 (24.5-25.6)	27.2 (26.6-27.7)
Test of heterogeneity results	I ² =99.25, P<0.000	I ² =99.51, P<0.000

* Confidence interval calculated by the author.

α Not applicable.

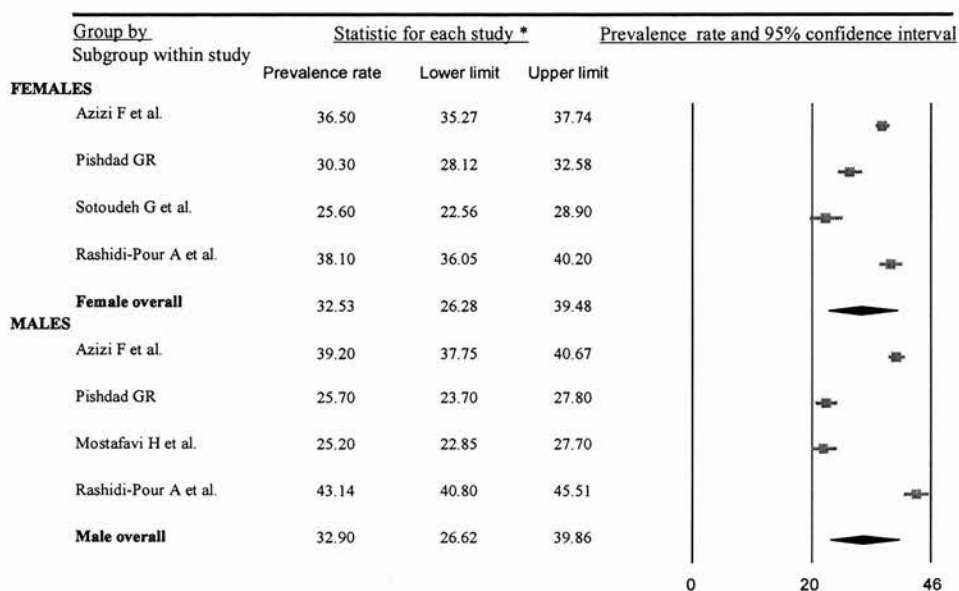
β Excluding findings of the studies of Amini et al. (453) and Pishdad. (482)

Thus in order to prevent bias resulting from the inclusion of highly heterogeneous studies in calculation of the point estimates (regarding the age of studied samples in this case) the study of Amini et al. (453) was excluded due to their focus on people from ≥ 40 age group. Study of Pishdad (482) also was excluded due to the date of its fieldwork in about 15 years ago.

In the included reports weight and height measurement methods and also appointed cut off points were almost identical but the studied age groups were not congruent. The highest age standardised prevalence of overweight in both males and females was calculated based on the data provided by Rashidy-Pour et al. (489) from Semnan province in the central part of Iran and the lowest one based on the data in the article of Mostafavi et al. (484) from Shiraz in South part of Iran (Table 4.7). Also according to the study of the Rashidy-Pour et al. (489) the highest age standardised rate of obesity was seen in their recruited sample in 2005-2006 (Table 4.8). Based on these findings Iranian women compared to men suffer from a higher rate of obesity. The difference was evident by higher mean BMI of Iranian women in almost all of the included studies (Table 4.9). As a result pooled mean BMI also was higher for the Iranian women than men.

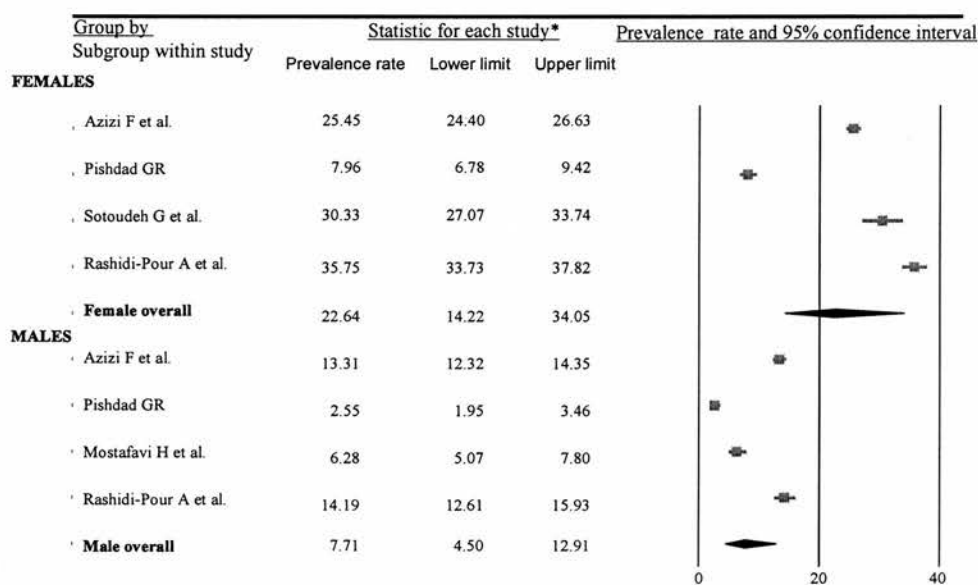
In order to make a robust decision in selecting a proper model for the meta-analysis of the findings the Q test was conducted to clarify any possible homogeneity or heterogeneity among the studies' results. The test indicated that a considerable heterogeneity exists among articles reporting the prevalence of overweight ($P= 0.000$, $I^2= 95.84$ in female and $P< 0.000$, $I^2< 98.63$ in the male subgroups) and obesity ($P< 0.000$, $I^2= 99.10$ in females and $P<0.000$, $I^2= 98.70$ in male subgroups) both in male and female subgroups. It was based on the findings of this primary analysis that a random effects model was applied to estimate the prevalence of overweight and obesity in the Iranian indigenous population.

Subgroup analysis of the calculated age standardised rates revealed that 32.5% (95% CI: 26.3-39.5) of Iranian women and 32.9% (95% CI: 26.6-39.9) of men were overweight (Figure 4.4). Also 22.6% (95% CI: 14.2-34.1) of Iranian women and 7.7% (95% CI: 4.5-12.9) of men were obese according to the results (Figure 4.5).



* Since entered prevalence rates automatically rounded up by the CMA software to calculate the confidence interval limits you may notice their very small differences with the given limits in the summary tables.

Figure 4.4 Overall pooled estimates from the standardised prevalence rates of overweight in studies on the Iranian adult population.



* Since entered prevalence rates automatically rounded up by the CMA software to calculate the confidence interval limits you may notice their very small differences with the given limits in the summary tables.

Figure 4.5 Overall pooled estimates from the standardised prevalence rates of obesity in studies on the Iranian adult population.

The studies conducted on the Iranian migrants residing in Australia (305), Norway (391) and Sweden (509) have indicated very different findings regarding the prevalence of overweight and obesity both in male and female subgroups. Rissel et al. (305) for instance suggested that 36.04% (95% CI: 30.00-42.50) of Iranian men and 29.26% (95% CI: 23.20-36.11) of women in Australia are overweight or obese. The study of Glenday et al. (391); however, has shown that 70.95 % (95% CI: 62.49-80.24) of men and 58.82% (95% CI: 49.48-69.43) of Iranian migrant women in Norway suffer from overweight or obesity. Moreover, in their study on a group of Iranian women in Sweden Daryani et al. (509) have revealed that 13.00% (95% CI: 6.80-22.40) of them were obese.

Probably these differences in the reported prevalence rates stem primarily from the heterogeneity in the methodology used and also from a real difference between subgroups of Iranian migrants in different countries. But regarding the reported unadjusted rates, the observed differences should be interpreted by caution.

4.3.2.5 Dyslipidaemia

From a total of 28 included publications, 11 articles (391, 416, 453, 456, 466, 469, 471, 486, 490, 496, 509) were found to have information about dyslipidaemia based on the level of total cholesterol (TC), high density lipoprotein (HDL-C), low density lipoprotein (LDL-C) or triglycerides (TGs) (Table 4.10). Two articles were reporting dyslipidaemia in a group of Iranian migrant population in Norway (391) and Sweden. (509) Among the other nine studies which were presenting prevalence of dyslipidaemia in the Iranian adult population, seven reports (453, 466, 469, 471, 486, 490, 496) did not provide sex specific age adjusted prevalence rates or/and the data to be able to calculate standardised prevalence rates (Table 4.11). The applied cut off points to determine abnormal cases are almost identical in the studies of Sarraf-Zadegan et al. (456), Azizi et al. (416) and Nadimi et al. (486) but different from other included studies. For instance the cut off point used to define abnormally high level of triglycerides (≥ 2.2 mmol/l) in the study by Fakhrzadeh et al. (471) is 100% lower than the cut off points (≥ 4.4 mmol/l) that were used by Aziz et al. (416) and Sarraf-Zadegan et al. (456)

Table 4.10 Provided information about the measurement methods of blood lipids in the included studies on Iranian indigenous and migrant adult population.

Study/age group/location/ fieldwork or publication date	Given information about the measurement method	
	Studies in Iran	
Kimiagar M et al (482)/ > 40 years (National-1990-1992)	NP *	
Amini M et al (453)/ ≥ 40 years (Isfahan-1993)	Fasting blood sample (after 8 hours overnight) was drawn a day after other clinical measurements.	
Roohafza H et al. (466)/ ≥ 20 years old (Isfahan-1993 to 1994)	Fasting blood sample (12 hours) was drawn.	
Sarraf-Zadegan N et al. (456)/ 20-70 years (Isfahan-published in 1999)	Fasting blood sample (14 hours) was drawn.	
Azizi F et al (416)/ ≥ 20 years (Tehran- 1999 to 2001)	Fasting blood samples (12-14 hours) were drawn between 7-9 am in the sitting position and centrifuged within 30-45 minutes of collection.	
Sarraf-Zadegan N et al. (469)/ ≥ 19 years (Isfahan-2000 to 2001)	Blood samples were taken after 12h fasting for TG and HDL-C analysis.	
Fakhrzadeh H et al (471)/ 25-64 years (Tehran-2002)	Fasting blood sample (for at least 12 hours overnight) was drawn.	
Nadimi AE et al (486)/ ≥ 20 years (Rafsanjan- published in 2004)	Fasting blood sample (14 hours) was drawn early morning (7.30-9 am).	
Janghorbani M et al. (496)/ >25 years (National- 2004 to 2005)	Overnight fasting blood samples were taken for analysis.	
Studies on Iranians abroad		
Daryani A et al. (509) Women aged 35-64 (Sweden- 1998 to 2000)	FBS (after 12 hours) in the blood sample drawn in the morning between 7.15-9 am.	
Glenday K et al. (391)/ 31-60 years (Norway-2002)	Non fasting venous blood sample was drawn	

* Not provided

Table 4.11 Crude (PR%) and age standardised prevalence rate (SPR %) of dyslipidaemia by sex in the selected studies of Iranian indigenous and migrant adult population.

Study/Age group	Cut off points (mmol/l)	Sex	PR (95% CI)			
			High TC [*]	High LDL-C ^{**}	Low HDL-C ^α	High TGs ^β
Studies in Iran						
Kimiagar M et al. > 40 years (490)	TC≥ 6.24	Male	NP δ ^ε	NA	NA	NA
	NC ^ε					
	NA ^λ	Female	NP	NA	NA	NA
	NA		NC			
Amini M et al. ≥ 40 years (453)	TC> 6.2	Male	NP	NA	NA	
	NA		NC			
	NA	Female	NP	NA	NA	NP
	TGs> 2.2		NC			NC
Roohafza H et al. ≥ 20 years old (466)	TC> 5.2	Male	47.3 (45.8-48.7) [¥]	12.4 (11.5-13.3) [¥]	30.2 (29-31.5) [¥]	28.7 (27.5-30) [¥]
	LDL-C> 3.37		NC	NC	NC	NC
	HDL-C< 1.03, 1.3 ^Ω	Female	41.0 (39.6-42.4) [¥]	16.6 (15.5-17.7) [¥]	57.3 (55.9-58.7) [¥]	24.8 (23.6-26.1) [¥]
	TGs > 2.2 [‡]		NC	NC	NC	NC
Sarraf-Zadegan N et al. 20-70 years (456)	TC≥ 6.5	Male	21.1 (19.4-22.8) [†]	26.9 (25.0-28.9) [†]	56.0 (53.9-58.1) [†]	12.1 (10.8-13.6) [†]
	LDL-C≥ 4.2		17.1 (11.9-23.9) ^{††}	21.2 (18.3-24.4) ^{††}	52.7 (47.9-57.4) ^{††}	10.2 (8.1-12.7) ^{††}
	HDL-C< 0.90	Female	32.0 (30.1-34.0) [†]	42.9 (40.7-45.0) [†]	50 (47.9-52.1) [†]	5.7 (4.8-6.7) [†]
	TGs > 4.4		26.2 (21.5-31.3) ^{††}	34.4 (30.9-38.1) ^{††}	42.2 (38.4-46.1) ^{††}	3.9 (2.7-5.7) ^{††}
Azizi F et al. ≥ 20 years (416)	TC≥ 6.24	Male	19.3 (18.1-20.5) ^{††}	19.8 (18.6-21.0) ^{††}	32.0 (30.6-33.4) ^{††}	5.3 (4.6-6.0) ^{††}
	LDL-C≥ 4.14		16.2 (15.1-17.3) ^{††}	16.9 (15.8-18.1) ^{††}	31.2 (29.8-32.6) ^{††}	4.9 (4.3-5.6) ^{††}
	HDL-C< 0.90	Female	26.7 (25.6-27.8) ^{††}	24.9 (23.8-26.0) ^{††}	13.3 (12.4-14.2) ^{††}	3.4 (2.9-3.9) ^{††}
	TGs≥ 4.4		21.8 (20.8-22.9) ^{††}	21.1 (20.1-22.2) ^{††}	13.1 (12.3-14.0) ^{††}	2.7 (2.3-3.2) ^{††}

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Table 4.11 Crude (PR%) and age standardised prevalence rate (SPR %) of dyslipidaemia by sex in the selected studies of Iranian indigenous and migrant adult population (continued).

Study/Age group	Cut off points (mmol/l)	Sex	PR (95% CI)			
			High TC [*]	High LDL-C ^{**}	Low HDL-C ^α	High TGs ^β
Sarraf-Zadegan N et al. ≥ 19 years (469)	NA	Male	NA	NA	NP	NP
	NA				NC	NC
	HDL-C<1.04, 1.3 ^Ω TGs≥1.65 [‡]	Female	NA	NA	NP	NP
Fakhrzadeh H et al. 25-64 years (471)	TC≥ 5.2	Male	34.4 (31.1- 37.7) [‡]	1.3 (0.8-1.8) [‡]	19.6 (19.4-19.8) [‡]	34.1 (30.8-37.4) [‡]
	LDL-C≥ 4.14		NC	NC	NC	NC
	HDL-C<1.03	Female	44.5 (42.0-47.0) [‡]	2.0 (1.3-2.7) [‡]	10.3 (8.8-11.8) [‡]	32.6 (30.3-34.9) [‡]
	TGs≥ 2.2		NC	NC	NC	NC
Nadimi AE et al. ≥ 20 years (486)	TC≥ 6.24	Male	19.4 (15.0-24.8) [‡]	11.6 (8.3-16.4) [‡]	12.1 (8.6-16.8) [‡]	3.73 (1.9-6.8) [‡]
	LDL-C≥ 4.14		NC	NC	NC	NC
	HDL-C<0.91	Female	18.29 (14.1-23.8) [‡]	10.3 (7.0-14.7) [‡]	14.4 (10.5-19.3) [‡]	1.5 (0.6-4.1) [‡]
	TGs>4.4		NC	NC	NC	NC
Janghorbani M et al. >25 years (496)	NA	Male	NP	NA	NA	NA
	NA		NC			
	NA	Female	NP	NA	NA	NA
	NA		NC			
Studies on Iranians abroad						
Daryani A et al. Women aged 35-64 (509)	TC> 6.5	Male	NA	NA	NA	NA
	HDL-C< 1.29					
	NA	Female	13.0 (6.8-22.4) [‡]	NA	50.0 (39.3-62.0) [‡]	25.0 (16.7-36.6) [‡]
	TGs≥ 1.69		NC		NC	NC

Table continued on next page

Table 4.11 Crude (PR%) and age standardised prevalence rate (SPR %) of dyslipidaemia by sex in the selected studies of Iranian indigenous and migrant adult population (continued).

Study/Age group	Cut off points (mmol/l)	Sex	PR (95% CI)			
			High TC *	High LDL-C **	Low HDL-C ^α	High TGs ^β
Studies on Iranians abroad						
Glenday K et al. 31-60 years (391)	TC≥ 6.2	Male	23.7 (1.6-28.4) [‡]	NA	20.1 (16.3-24.6) [‡]	27.9 (23.5-32.8) [‡]
	HDL-C≤ 0.9, 1		NC	NC	NC	
	NA	Female	13.9 (10.0-18.8) [‡]	NA	8.5 (5.8-13.1) [‡]	18.9 (14.4-24.4) [‡]
	TGs≥ 2.7, 2.2 ^Ω			NC	NC	NC
* Total cholesterol	** Low density lipoprotein		^α High density lipoprotein	^β Triglycerides		
λ Not applicable	δ Not Provided: only mean level of studied variable was provided.	ϕ Sex specific mean levels were not provided.				
€ Not calculable: raw data were not provided in the article to be able to calculate age standardised prevalence rate.		Ω For men and women respectively.				
¥ Confidence interval calculated by the author.	‡ Or being under treatment.	† Age adjusted prevalence rate and its confidence interval calculated by the author.				
†† Standardised prevalence rate and its confidence interval calculated by the author.						

Thus the data derived from two publications (416, 456) in Iran were applied to calculate age standardised prevalence of dyslipidaemia and accordingly to estimate the pooled prevalence rate (Figure 4.6-4.9). However, data about the weighted sex specific mean level of the lipids in the studied samples were presented in seven publications (Table 4.12). (416, 456, 469, 471, 486, 490, 496) Based upon the overall point estimates were calculated separately for mean level of different lipids in the Iranian population.

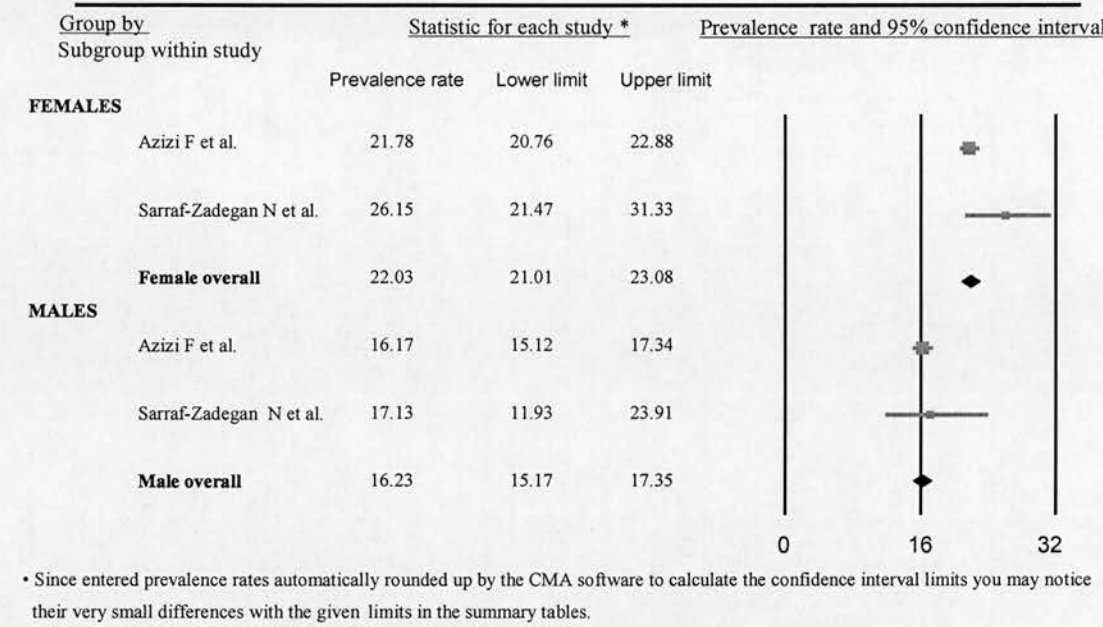
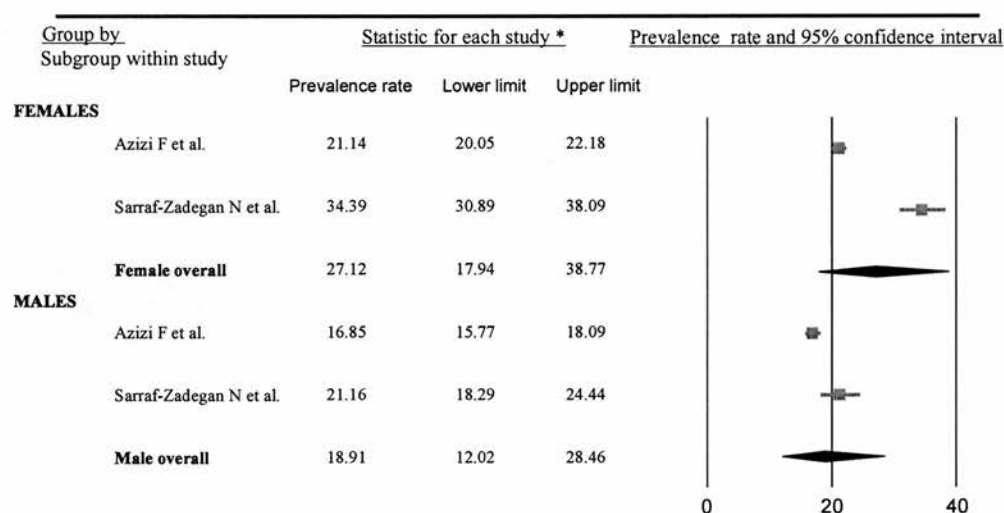


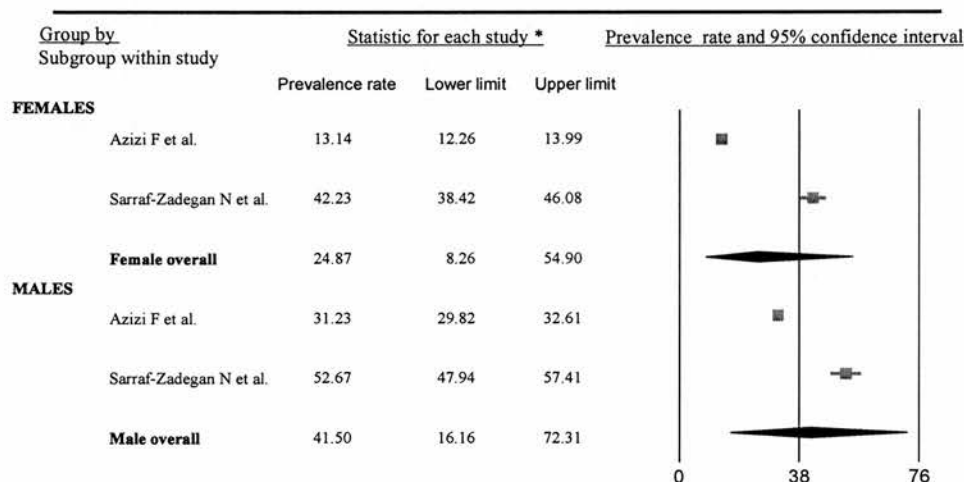
Figure 4.6 Overall pooled estimates from the standardised prevalence rates of hypercholesterolaemia in the eligible studies on Iranian adult population.

Pooled estimate of the prevalence of hypercholesterolaemia which was calculated based on the findings of only two studies in Iran (416, 456) suggests that Iranian women suffer significantly from a higher rate of hypercholesterolaemia than men. Sex specific weighted mean levels of total cholesterol which were reported in three included publications (416, 471, 496) also verifies this conclusion. However, pooled estimate of the mean cholesterol level which was based on the findings of five studies in Iran (416, 456, 471, 486, 496) did not concur with such an assumption.



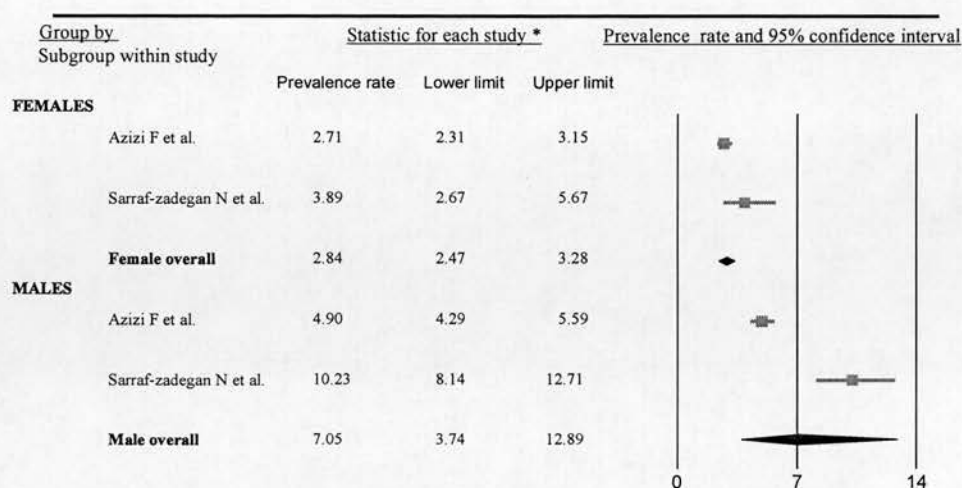
* Since entered prevalence rates automatically rounded up by the CMA software to calculate the confidence interval limits you may notice their very small differences with the given limits in the summary tables.

Figure 4.7 Overall pooled estimates from the standardised prevalence rates of abnormal high LDL-C level in the eligible studies on Iranian adult population.



* Since entered prevalence rates automatically rounded up by the CMA software to calculate the confidence interval limits you may notice their very small differences with the given limits in the summary tables.

Figure 4.8 Overall pooled estimates from the standardised prevalence rates of abnormal low HDL-C level in the eligible studies on Iranian adult population.



* Since entered prevalence rates automatically rounded up by the CMA software to calculate the confidence interval limits you may notice their very small differences with the given limits in the summary tables.

Figure 4.9 Overall pooled estimates from the standardised prevalence rates of hypertriglyceridaemia in the eligible studies on Iranian adult population.

The overall pooled estimate for mean levels of LDL-C, HDL-C and TGs also did not indicate statistically significant difference between Iranian men and women. This is while findings of a number of included studies indicated such a difference with regard to the mean levels of LDL-C (416, 456, 471), HDL-C. (416, 469, 471) and TGs. (416, 469) Bringing in mind the methodological heterogeneity was seen among the included studies and also applied cut off points to define abnormal cases it is recommended that all these findings to be interpreted by caution since it was not possible entirely to rule out the probability of measurement and reporting bias among the studies. As an example of diversity in reporting abnormal cases while Azizi et al. (416) have used ≥ 4.4 mmol/l level Sarrafi-Zadegan et al. (469) have applied ≥ 1.65 mmol/l level to label people with hypertriglyceridaemia.

I was discussed earlier that only two articles (391, 509) reporting the prevalence of dyslipidaemia in the Iranian ethnic minority living abroad had inclusion criteria to be included in this systematic review. One (391) of these papers reported the prevalence of

Table 4.12 Overall point estimates by sex for weighted mean levels (mmol/l) of different lipids reported in the included studies on Iranian indigenous adult population.

Studies	Lipids			
	TC *	LDL-C **	HDL-C †	TG ††
	Mean level, 95% CI ^α			
Amini M et al. (490)				
Male	5.53 (5.52-5.54)	NA ‡	NA	2.36 (2.35-2.37)
Female	5.75 (5.74-5.76)			2.28 (2.27-2.29)
Sarraf-Zadegan N et al. (456)				
Male	5.00 (4.88-5.12)	3.11 (3.06-3.16)	1.04 (1.03-1.05)	1.49 (1.45-1.52)
Female	5.17 (5.09-5.25)	3.30 (3.25-3.34)	1.05 (1.04-1.06)	1.46 (1.42-1.49)
Azizi F et al. (416)				
Male	5.30 (5.25-5.31)	3.39 (3.37-3.42)	0.98 (0.97-0.99)	2.02 (1.99-2.06)
Female	5.50 (5.46-5.52)	3.50 (3.48-3.52)	1.17 (1.16-1.17)	1.79 (1.77-1.82)
Sarraf-Zadegan N et al. (469)				
Male	NA	NA	1.10 (1.09-1.11)	2.01 (1.99-2.12)
Female			1.20 (1.19-1.21)	1.8 (1.78-1.82)
Fakhrzadeh H et al. (471)				
Male	4.79 (4.71-4.88)	2.46 (2.40-2.52)	1.40 (1.36-1.43)	2.21 (2.06-2.37)
Female	5.08 (5.00-5.15)	2.62 (2.56-2.68)	1.58 (1.55-1.61)	2.00 (1.91-2.10)
Nadimi AE et al. (486)				
Male	5.20 (5.05-5.35)	2.98 (2.86-3.11)	1.23 (1.20-1.27)	2.14 (1.98-2.30)
Female	5.06 (4.90-5.22)	2.90 (2.77-3.02)	1.30 (1.26-1.35)	2.00 (1.86-2.14)
Janghorbani M et al. (496)				
Male	5.09 (5.08-5.10)	NA	NA	NA
Female	5.35 (5.33-5.36)			
Overall point estimate ^β				
Male	5.1 (5.0-5.2)	3.00 (2.56-3.45)	1.18 (1.06-1.29) ^λ	2.06 (1.99-2.12) ^λ
Female	5.2 (5.1-5.4)	3.06 (2.61-3.51)	1.31 (1.20-1.43) ^λ	1.86 (1.80-1.93) ^λ
Test of heterogeneity results				
Male	I ² =97.82, P<0.000	I ² =99.80, P<0.000	I ² =99.65, P<0.000	I ² =67.55, P=0.026
Female	I ² =97.44, P<0.000	I ² =99.44, P<0.000	I ² =99.59, P<0.000	I ² =88.54, P<0.000

* Total cholesterol.

** Low density lipoprotein cholesterol.

† High density lipoprotein cholesterol.

†† Triglycerides.

‡ Not applicable.

^α Confidence interval calculated by the author.

^β Excluding findings of the study of Amini M et al. (490).

^λ Excluding findings of the study of Sarraf-Zadegan N et al. (456).

dyslipidaemia in a group of Iranian migrants in Norway and the other one (509) indicated the rate on a group of Iranian female migrants in Sweden. In the later corresponding study LDL-C level was not measured. As shown in Table 4.11, different cut off points had been applied by authors of the two included articles especially in relation to the TG and HDL-C abnormal levels. The rates presented in the study of Glenday et al. (391) were adjusted for age but in the study of Daryani et al. (509) adjustment of reported rates for age has not been mentioned. Thus with such a heterogeneity in the applied methodology and data reporting it was not possible to pool the data about Iranian migrants for the purpose of this systematic review.

4.3.2.6 Diabetes

Crude and age standardised prevalence rates of diabetes in several samples of Iranian adult population are shown in Table 4.13. Since US unit is in use to report glucose levels in Iran, quantities of glucose in US units were divided by 18 as a conversion factor into SI units where appropriate. In two articles (466, 496) age adjusted prevalence rates or even necessary data to calculate them were not provided. In the papers of Larijani et al. and Azizi et al. (487, 491) needed data to calculate the standardised prevalence rates were not included in the published article. The study of Daryani et al. (509) was on a group of Iranian (n=71) migrant women in Sweden but did not provide age adjusted prevalence rate of diabetes. Thus only six publications (416, 453, 456, 471, 488, 497) remained for meta-analysis. To prevent over estimation bias findings of the study of Amini et al. (453) were excluded from the analysis since it was conducted on subjects over 40 years old in 1993. As displayed in the table, studied age groups, measurement protocols and even applied cut off points (based on the World Health Organisation 1985 or 1988 or American Diabetes Association criteria) (515) were somewhat different in the included articles. Age standardised prevalence rate of diabetes in one national (497) and one large scale study in Tehran (416) was indicated that Iranian women have a significantly higher rate of diabetes compared to men. However, findings of other included studies did not show such a difference. Findings of the study of Fakhrzadeh et al. (471) which was conducted in one of the almost deprived part of Tehran indicated significantly higher prevalence rate of diabetes (13%) among studied women compared to the rate (8.6%) was seen in the study of Azizi et al. (416) in the Eastern region of Tehran. These differences along with disparities was seen in studies which were conducted in different part of Iran must be interpreted by caution due to the differences in the studied age groups and also applied methodology. Even so, the observed difference between Iranian men and women especially in deprived regions warrant further scrutiny.

Only one study (509) was found in this systematic review investigating the prevalence of diabetes in a group of Iranian migrant women in Sweden. Despite application of a lower cut off point (≥ 6.1 mmol/l) and inclusion of subjects from the age group of 35-64

Table 4.13 Crude (PR%) and age standardised prevalence rate (SPR%) of diabetes by sex in the selected studies of Iranian indigenous and migrant adult population.

Study/age group/ location/fieldwork or Publication date	Measurement method	Cut off point	PR (95% CI)	
			Male	Female
Studies in Iran				
Amini M et al. (453) ≥ 40 years (Isfahan-1993)	OGT / being under treatment or diabetic (detected by a physician) (WHO **, 1985 criteria)	2h PG* ≥ 11.1 mmol/l	7.54 (6.2-8.8) ^α	8.0 (6.8-9.2) ^α
Roohafza H et al. (466) ≥ 20 years (Isfahan-1993 to 1994)	FBS ^α (after 12 hours) or OGT / or being under treatment (ADA [‡] 1997 criteria)	FBS > 7.0 mmol/l or 2h PG ≥ 11.1mmol/l	7.19 (6.1-8.5) ^β	7.8 (6.8-9.0) ^β
Larijani B et al. (487) 30-64 years (Bushehr-1996)	OGT / being under treatment or diabetic (detected by a physician) (WHO criteria) ^{††}	2h PG ≥ 11.1 mmol/l	3.5 (3.0-4.1) ^α	4.3 (3.7-4.9) ^α
Sarrafi-Zadegan N et al. (456) 20-70 years (Isfahan-published in 1999)	FBS / known diabetes (WHO 1985 criteria)	FBS ≥ 7.8 mmol/l	NC [†]	NC
Azizi et al. (416) ≥ 20 years (Tehran- 1999 to 2001)	OGT (WHO 1985 criteria)	2h PG ≥ 11.1 mmol/l	12.9 (10.4-15.4)	12.0 (9.5-14.5)
Sarrafi-Zadegan N et al. (469) ≥ 19 years (Isfahan-2000 to 2001)	FBS (after 12 hours) or OGT/ being under treatment (The criteria was not specified)	FBS ≥ 6.1 mmol/l ^ε	NC	NC
Azizi F et al. (491) ≥ 30 years (National-1999-2001)	FBS (after 12 hours) or OGT / known diabetics (ADA 1997 criteria)	FBS ≥ 7 mmol/l or 2h PG ≥ 11.1mmol/l	2.6 (2.6-2.7) ^α	4.3 (4.3-4.4) ^α
Fakhrzadeh H et al (471) 25-64 years (Tehran-2002)	FBS (after 12 hours) (ADA 1997 criteria)	2h PG ≥ 11.1 mmol/l	NC	NC
			8.9 (7.5-10.3) ^α	12.2 (10.6-13.8) ^α
			8.8 (6.8-11.3) ^β	13.0 (11.0-15.3) ^β

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Table 4.13 Crude (PR%) and age standardised prevalence rate (SPR%) of diabetes by sex in the selected studies of Iranian indigenous and migrant adult population (continued).

Study/age group/ location/fieldwork or Publication date	Measurement method	Cut off point	PR (95% CI)	
			Male	Female
Studies in Iran				
Janghorbani M et al. (496) >25 years (National- 2004 to 2005)	FBS (overnight) (The criteria was not specified)	NA [§]	NP	NP
Esteghamati A et al. (497) 25-64 years (National -Jan-Feb 2005)	FBS (after 12 hours) / doctor diagnosed known diabetes (WHO 1999 criteria)	FBS ≥ 7 mmol/l	NC	NC
Azimi-Nezhad M et al. (488) 15-64 years (Greater Khorasan province- Published in 2008)	FBS (overnight fasting) (ADA 1997 criteria)	FBS ≥ 7 mmol/l	7.1 (6.8-7.4) 4.2 (3.4-5.3)	8.3 (8.0-8.7) 3.7 (3.0-4.7)
Studies on Iranians abroad				
Daryani A et al. (509) Women aged 35-64 (Sweden- 1998-2000)	FBS (after 12 hours) (The criteria was not specified)	FBS ≥ 6.1 mmol/l	NA	4.2 (1.4-11.7) ^a NC

* Oral glucose tolerance test. ** World Health Organisation. ‡ Two hours post load plasma glucose level.
^α Confidence interval calculated by the author. β Standardised prevalence rate and its confidence interval calculated by the author.
^λ Fasting blood sugar. ¥ American Diabetes Association
[†] Not calculable: raw data were not provided in the article to be able to calculate age standardised prevalence rate.
^{††} Version not specified. δ Age adjusted prevalence rate and its confidence interval calculated by the author.
[€] Results for OGT test were not given. Ω Not Provided: only mean level of studied variable was provided. ø Not applicable.

years to identify diabetic patients, the findings suggested that only 4.2% of the study participants are diabetic. But it was not clear from the provided explanations whether the reported prevalence rate is adjusted for age or not.

The overall point estimate of the age standardised prevalence rate of diabetes in the Iranian studies did not show any difference between sexes (Figure 4.10). Regarding the heterogeneity was seen in the subgroup analysis of the included studies ($I^2= 88.98$, $P< 0.000$ in male and $I^2=96.32$, $P<0.000$ in females subgroups) random effects model was used to calculate the pooled estimates.

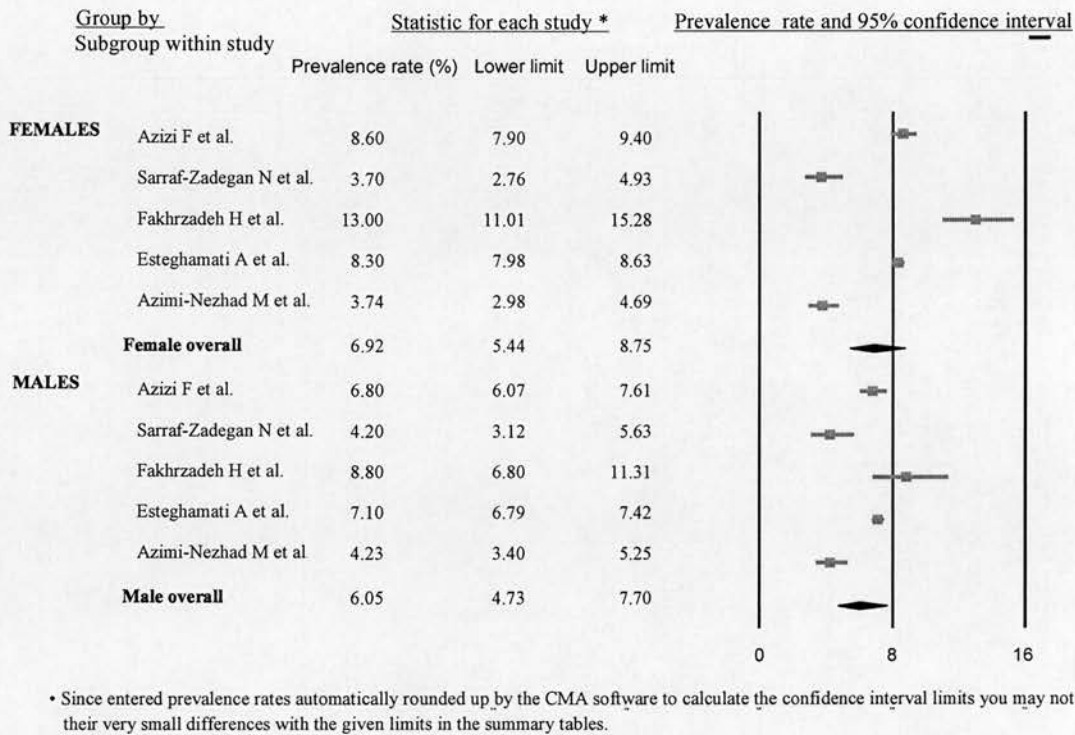


Figure 4.10 Overall pooled estimates from the standardised prevalence rates of diabetes in the eligible studies on Iranian adult population.

Mean level of fasting blood glucose was reported in four articles (Table 4.14). A statistically significant difference between Iranian men and women was seen in two studies (471, 496). One of these studies was a country wide study (496) and the other one (471) was conducted in Tehran. However, findings of other two studies and also the

Table 4.14 Overall point estimates by sex for weighted mean levels (mmol/l) of fasting blood sugar reported in the included studies on Iranian indigenous adult population.

Studies	Male	Female
	Mean level, 95% CI *	
Azizi F et al. (416)	5.44 (5.39-5.49)	5.44 (5.39-5.49)
Sarraf-Zadegan N et al. (469)	4.60 (4.56-4.64)	4.60 (4.56-4.64)
Fakhrzadeh H et al. (471)	4.40 (4.26-4.54)	4.62 (4.57-4.67)
Janghorbani M et al. (496)	5.34 (5.32-5.37)	5.47 (5.45-5.49)
Overall point estimate	4.95 (4.47-5.43)	5.03 (4.56-5.51)
Test of heterogeneity results	$I^2=99.76$, $P<0.000$	$I^2=99.86$, $P<0.000$

* Confidence interval calculated by the author.

estimated pooled mean of FBS did not confirm presence of any difference between men and women.

4.3.2.7 Results' summary

A summary of the point estimates from the age standardised prevalence rates of the studied CVD risk factors in Iran are provided in Table 4.15. As seen, major differences seem to exist between two sexes in the Iranian population with regard to the smoking and obesity. Due to the reasons like limited number of eligible studies, considerable amount of heterogeneity in the applied methodology and differences in the study location or fieldwork date, the calculated confidence limits are wide for the pooled estimates of prevalence rates for some of the risk factors.

Due to the sparse number of studies on Iranian migrants it was not possible to pool data presented in the eligible studies to calculate overall estimates of the CVD risk factors for this ethnic minority. But in order to have an overall view about the studied

CVD risk factors and the differences exist in the applied methodology and reported rates, findings of the identified studies regarding the prevalence of CVD risk factors among Iranians in different countries of the world were summarised in Table 4.16.

Table 4.15 Pooled point estimates from the sex specific and age standardised prevalence rate (SPR%) of the major CVD risk factors reported for the Iranian indigenous adult population.

Variables	SPR (95% CI)	
	Male	Female
Smoking *	17.65 (10.19-28.82)	1.25 (0.64-2.44)
Hypertension **	25.33 (15.81-38.00)	23.92 (14.84-36.20)
Overweight †	32.90 (26.62-39.86)	32.53 (26.28-39.48)
Obesity ††	7.71 (4.50-12.91)	22.64 (14.22-34.05)
Dyslipidaemia		
Hypertriglyceridaemia ‡	7.05 (3.74-12.89)	2.84 (2.47-3.28)
Hypercholesterolaemia ±	16.23 (15.17-17.35)	22.03 (21.01-23.08)
High LDL-C α	18.91 (12.02-28.46)	27.12 (17.94-38.77)
Low HDL-C β	41.50 (16.16-72.31)	24.8 (8.26-54.90)
Diabetes λ	6.05 (4.73-7.70)	6.92 (5.44-8.75)

* Self reported smoking: at least one cigarette a day.

** SBP≥ 140 mmHg or DBP≥ 90 mmHg or using anti-hypertensive medication.

† 25≤ BMI<30 kg/m² †† BMI≥30 kg/m² ‡ TGs≥4.4 mmol/l

± TC≥ 6.5 mmol/l in one study and TC≥ 6.24 mmol/l in another one.

α LDL-C≥4.14 mmol/l in one study and LDL-C≥4.20 mmol/l in the another one.

β HDL-C<0.90 mmol/l.

λ 2h PG≥11mmol/l or FBS≥ 7 mmol/l in four studies and FBS ≥7.8 mmol/l in one study.

Since these prevalence rates were not adjusted for a standard population they can not be compared reliably with the standardised prevalence rates calculated for Iranian indigenous population.

4.4 Discussion

The study findings indicated that there are only a few comprehensive studies on the prevalence of CVD risk factors in Iran with substantial heterogeneity in the methodologies used. The observed heterogeneity of the applied study protocols (even

when studying identical variables) heralds the importance of adherence to a standard study protocols when doing research on the prevalence of CVD risk factors.

Table 4.16 Prevalence rate (PR%) of the major CVD risk factors by sex reported in the studies on Iranian migrant adult population.

Variables	PR (95% CI)		
	Studies		
	Rissel C et al. (305) **	Daryani A et al. (509) **	Glenday K et al. (391) †
Smoking *			
Male	23.9 (18.7-29.9) ±	NA ‡	11.2 (8.3-14.9) ±
Female	17.0 (12.3-23.0) ±	21.0 (13.2-32.0) ±	10.5 (7.2-15.1) ±
Hypertension ††			
Male	NS ‡‡	NA	14.0 (10.8-17.9) ±
Female	NS	6.0 (2.2-13.6) ±	10.9 (7.6-15.5) ±
Overweight ^α			
Male	36.0 (30-42.5) ±	NS	71.0 (62.5-80.2) ± €
Female	29.3 (23.2-36.1) ±		58.8 (49.5-69.4) ± €
Obesity ^β			
Male	NS	NA	NS
Female		13.0 (6.8-22.4) ±	
Hypertriglyceridaemia ^λ			
Male	NS	NA	27.9 (23.5-32.8) ±
Female		25.0 (16.7-36.6) ±	18.9 (14.4-24.4) ±
Hypercholesterolaemia ^δ			
Male	NS	NA	23.7 (1.6-28.4) ±
Female		13.0 (6.8-22.4) ±	13.9 (10-18.8) ±
Low HDL-C [¥]			
Male	NS	NA	20.1 (16.3-24.6) ±
Female		50.0 (39.3-62.0) ±	8.8 (5.8-13.1) ±
Diabetes ^ϕ			
Male	NS	NA	NS
Female		4.2 (1.4-11.7) ±	

* Self reported: at least one cigarette a day.

** Age adjusted rates were not provided.

† Age adjusted prevalence rates were provided: confidence interval calculated by the author.

‡ Not applicable.

± The confidence interval calculated by the author.

†† SBP ≥ 140 mmHg or DBP ≥ 90 mmHg or using anti-hypertensive medication.

‡‡ Not studied.

α 25 ≤ BMI < 30 kg/m²

€ Reported rate in this article shows the prevalence of overweight and obesity together.

β BMI ≥ 30 kg/m²

λ TGs ≥ 4.4 mmol/l

δ TC ≥ 6.5 mmol/l in the study of Daryani et al. and TC ≥ 6.2 mmol/l in the study of Glenday et al.

¥ HDL-C ≤ 1.29 mmol/l in the study of Daryani et al. and HDL-C ≤ 0.9 and 1 mmol/l for men and women in the study of Glenday et al.

ϕ FBS 6.1 mmol/l.

This heterogeneity in applied methodology also indicates the challenges other researchers may face in meta-analysis of the findings of these divergent studies.

Intuitively, differences in the underlying characteristics inherent among descriptive epidemiological studies (studying different samples chosen from different locations within the larger community or time lag between studies) may also have proportional effect on the observed variations. For instance, the observed prevalence rates of different CVD risk factors in this systematic review considerably were divergent depending on the date of fieldwork and location of studies.

Reporting bias was one of the other important considerations in this meta-analysis. As a result, complying with a standard reporting protocol by Iranian researchers may prevent major biases in the future studies (e.g. under or over reporting of the prevalence of a CVD risk factor due to use of unconventional cut off points or interpretation of crude prevalence rates instead of age adjusted or standardised rates). Thus application of more stringent methods than hitherto for analysis and reporting of data must be regarded as *sine qua non* for researchers.

This study is the first comprehensive systematic review of the prevalence studies on the major CVD risk factors in the Iranian original and migrant populations. Findings of this systematic review raise major concerns about the prevalence of a number of CVD risk factors (obesity and low level of HDL-C) in the Iranian population especially with observed differences between men and women. The overall pooled estimate of the reported prevalence rates in the Iranian eligible studies revealed that about 23% of women and only about 8% of men suffer from obesity. The difference may stem from lower physical activity levels of Iranian women due to a variety of reasons such as their unequal access to health and fitness clubs in Iran.

Since there are a few empirical data on the Iranian Diaspora with regard to the prevalence of CVD risk factors, it was not possible to calculate overall summary prevalence rates in this ethnic group for comparison purposes. There is some evidence suggesting the change in CVD risks among migrant populations compared to their country of origin. Limited available evidence (305, 391, 509) indicated that the prevalence of hypertension in both sexes and obesity in women is considerably lower and the prevalence of self reported smoking rate among Iranian migrant women is markedly higher compared to their counterparts of same gender in Iran.

As discussed before a sizeable number of Iranians are now living in the U.S and different European countries. Due to our insufficient knowledge about Iranian migrants' CVD profile, it is practically difficult to judge about their risk status after migration. Therefore performing of a future population based study on this ethnic group to clarify their CVD risk status will be informative and strongly recommended.

This review had its own weaknesses and strength. All efforts were made to perform a comprehensive search of the literature to minimise probability of publication bias. Unfortunately due to limited number of eligible studies in this review (less than 10 in each subgroup) it was not possible to analyse the findings for publication bias as a source of heterogeneity. (514, 516) Only a funnel plot (Figure 4.11) from the publications reporting the prevalence of diabetes in the Iranian indigenous population is provided as an example of primary visual tool for the investigation of possible publication bias in the meta-analysis of prevalence studies.

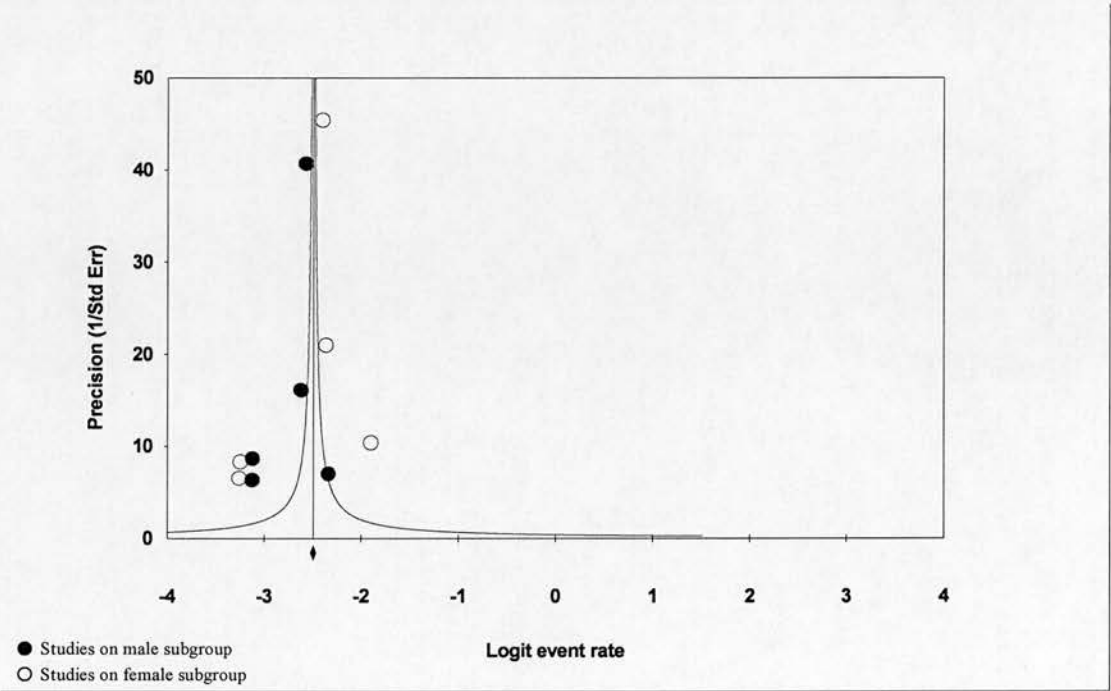


Figure 4.11 Funnel plot of precision by logit prevalence rate to evaluate publication bias in the systematic review of studies reporting the prevalence of diabetes in the Iranian indigenous adult population.

As shown, there is no indication of major asymmetry and thus no evidence of publication bias. It is very likely that the observed variations were produced by mainly divergences in the methodologies, measurement or reporting biases. They also may represent just regional variations or pattern of change in the prevalence of different CVD risk factors by time. Due to small number of eligible studies it was not possible to rule out all these possibilities by certainty. Considering the evidence presented here it is very important to the Iranian researchers to comply with standard protocols in doing research on the prevalence of different CVD risk factors. Without such a most needed revision and with the current amount of methodological heterogeneity in the CVD related epidemiological studies, reaching to a soundly based and robust conclusion in future systematic reviews will be very unlikely.

In this review an extensive search had been done to find out all studies, regardless of their publication place and language (English or Persian) but some limitations of this review warrant to be addressed. Few authors reported participation rates or explained characteristics of those refused to participate in their studies. Many of the included articles had poor reporting quality and in some cases proposed measures were calculated manually based on the provided raw data.

Every effort was made to track down unpublished study and grey literature but this research is unable to rule out the possibility of detection bias entirely. To make contact with researchers or even after contacting them to get a copy of full results from their presented abstracts in conferences or brief summary of results in informal publications was not always successful. Therefore, included in this analysis only are those studies that were accessible and consistent with the inclusion criteria.

Reliance was on the information reported in the articles. In some cases (471, 484) there was mismatch between numbers in the texts and tables. To resolve these mismatches authors of the articles were contacted. In one case the response was received confirming that the mismatch is a typo. (484) In many reports there were not enough details about applied methodology for data gathering or data analysis.

The strength of the review could be greatly improved if it was possible to have access to all journals; thesis or unpublished documents had been published in Persian mostly in

Iran which is not possible currently. This is the result of limitations in having remote access to the findings of scientific publications in this country due to lack of systematic data storage and sharing infrastructure within the academic institutions.

Since only few studies were conducted on the Iranian migrant population to investigate their health status and among them even very few focused on the prevalence of CVD risk factors in this ethnic group, the data provided in this review may not be generalisable to all Iranians living abroad. Considering the available data from identified studies on the Iranian migrants, it was noticeable that except smoking, prevalence of the other major risk factors was lower among the migrants compared to the Iranian general population (Table 4.15 and Table 4.16). This could be the consequence of major differences in the community resources including access to health care services, supportive legislation and even life style skills in the country of origin with those structured in the mostly developed destination countries. However; selection and reporting bias or bias due to use of an unreliable measurement method are other possibilities. There are strong cultural barriers for instance in Iran with regard to smoking females. As a result there is a sense of stigma among women which inhibits them to explore their smoking behaviour to strangers. Thus reliance solely on the self reported smoking data in the Iranian studies could provoke major bias in the estimated overall prevalence rate of smoking in this sex group.

This systematic review is a major step in the epidemiological research on the prevalence of CVD risk factors in this population. Thus its findings can help researchers and policy makers to take informed decisions when dealing with the prevalence of major CVD risk factors in the Iranian original and migrant populations.

4.6 Abstract

Introduction: As explained in the previous chapter, there has been increasing migration from Iran to countries all over the world in the last three decades. There is no comprehensive systematic review of studies on the prevalence of CVD risk factors ever undertaken among Iranians and for this reason interpretation and comparison of the results is burdensome.

Methods: Nine data bases along with other appropriate electronic resources were searched to identify possibly all studies that have measured the prevalence of CVD risk factors in the Iranian indigenous or migrant populations and their accuracy and quality were assessed.

Results: From a total of 104 potentially relevant publications, 28 articles were scrutinised and substantial heterogeneity in the applied methodology were observed. Based on the overall pooled estimates obesity was prevalent among 22.64% (95% CI: 14.22-34.05) of the women and 7.71% (95% CI: 4.50-12.91) of Iranian men. Self reported smoking rate was estimated to be 17.65% (95% CI: 10.19-28.82) in men and only 1.25% (95% CI: 0.64-2.44) in Iranian indigenous women. This is while the lowest reported prevalence rate of smoking among Iranian migrant women so far is 10.5% (95% CI: 7.2-15.1).

Conclusion: Findings of this systematic review raise major concerns about the prevalence of a number of CVD risk factors and also differences between men and women in the Iranian population. Due to a few empirical data it was not possible to calculate overall prevalence rates of CVD risk factors for the Iranian Diaspora. A proposal was set out to do a pilot study on the prevalence of major CVD risk factors among Iranian ethnic group in Edinburgh as a prerequisite for a UK wide study. This proposal is described in the next chapter.

Chapter Five: Methodology of the field work: a pilot study of the prevalence of established cardiovascular disease risk factors among Iranians in Edinburgh

5.1 Introduction

In the two previous chapters it was discussed that there is a growing population of Iranians abroad and so study of determinants of health in this ethnic minority group is vital. However, it was discussed that there is a huge gap in the evidence and the research evidence on which to base health care planning and provision decisions for the Iranian Diaspora is very limited. With dispersion of Iranian migrants within the general population in the destination countries conducting of population-based studies on this minority group is challenging. Only a few comprehensive studies exist on the prevalence of cardiovascular disease (CVD) risk factors in Iran with substantial heterogeneity in the methodologies used. Also a few empirical data on the Iranian Diaspora were identified with regard to the prevalence of CVD risk factors. So it was not possible to calculate an overall summary prevalence rates in this ethnic group for comparison purposes. This chapter explain the methodology of a pilot study which was set out to investigate the prevalence of major CVD risk factors amongst Iranians living in Edinburgh as the first study of Iranian Diaspora ever undertaken in the UK.

5.2 Outline of research

In the previous chapters (pages 1-5) it was indicated that major variations exist among ethnic migrant groups compared to the indigenous population in the destination countries and population of the country of origin regarding the prevalence of

cardiovascular disease risk factors. But due to our insufficient knowledge about Iranian migrants' CVD profile it is not possible to have a precise judgement about their risk status after migration. Therefore, a proposal was set out to conduct a pilot population-based study on the prevalence of major CVD risk factors amongst Iranians living in Edinburgh. The ultimate goal was to develop methods, gain experience and to acquire estimates to inform a full scale future study.

5.2.1 Research proposal

Findings of this study will answer the following questions:

1. Is it possible to construct a sampling frame of Iranians living in Edinburgh?
2. What kinds of concerns have Iranians about answering a study questions through face-to-face interview or being a subject of physical examination or invasive tests (e.g. blood sampling)?
3. Are there any special preferences among Iranians to have physical examination or assessment being undertaken by practitioner of same gender?
4. Can the Scottish Health Survey questionnaires be adapted for the Scottish Iranian population?
5. What proportion of Iranian subjects in the study of this kind need translated materials or translation to complete the procedure?
6. What proportion of those invited to participate in a study of this kind give their consent and actually participates in the study?
7. What is the estimated prevalence of major CVD risk factors among the Iranian living in Scotland? (This could be used for calculation of sample size in the future population based CVD studies on Iranians living in Scotland).
8. Are there any major differences between Iranian migrants in Edinburgh with Iran's indigenous population or Scottish White population regarding the prevalence of CVD risk factors?

5.3 Study questionnaires

Since one of the objectives of this study was to compare the status of Iranian subjects living in Edinburgh with the status of general Scottish White and Iranian indigenous population with regard to the major CVD risk factors, application of the

questionnaires and measurement methods that are standard in CVD epidemiology were considered. Thus Scottish Health Survey (2003) was selected as one of the key surveys and data collection technique in this study was modelled on that. These questionnaires were translated into Persian and their face validity was assessed and confirmed by one of the study supervisors (Dr Farshid Namdaran) who was fluent in academic English and Persian. The study participants were given choice to choose original English (Appendix nine) or translated questionnaires (an electronic copy is provided in the attached CD to the back cover of the thesis) to be completed by face-to-face interview. So another purpose of the pilot study was to assess face validity of the questionnaires.

5.4 Ethical approval

Research involving the national health system (NHS) staff, patients (alive or recently dead), data, premises or facilities in the UK must go through an NHS Research Ethics Committee. (517) Application for the local NHS ethics committee (Lothian Research Ethics Committee) approval was submitted at 30th November 2005 and a favourable ethical opinion was received at 18th May 2006 (Appendix ten).

5.4.1 Other approvals (NHS Research and Development Approval, Study site approval, the University of Edinburgh's Health and Safety Department approval, Enhanced Disclosure)

In addition to the NHS ethics committee approval every health and social care research in the UK also needs the local NHS Research and Development Office (R&D) approval for each of the NHS organisation where the project will take place. (518) The R&D approval was received for this study at 23rd of May 2006 (Appendix 11). Study site approval (Wellcome Trust Clinical Research Facility at Edinburgh's Western General Hospital) also was needed to commence this study which was granted at 13th April 2006 (Appendix 12). The University of Edinburgh's Health and Safety Department approval also was required to include the investigators and their study participants within the liability insurance cover held by the university. This approval was achieved on 16th March 2006 (Appendix 13). To complete the list of needed approvals the requested enhanced disclosure for the main investigator should also be added. This disclosure was issued by the Scottish Criminal Record Office on 3rd of February 2006 (Appendix 14).

Separate application forms were filled out to get all needed approvals before starting the pilot study.

5.5 Research design

This pilot study was a cross-sectional population-based study on the prevalence of the major CVD risk factors among Iranian migrants in Edinburgh. As a preliminary work a systematic review was carried out to provide a comprehensive tabulation of available data on recruitment methods have been used successfully in studies on the Iranians living abroad (page 56-80). According to the findings of this review no single method of recruitment can be considered a gold standard in studies on Iranian migrants since similar methods in varying circumstances have led to differing results. Therefore multi-method sampling technique was decided to be used in this study.

Another systematic review was implemented on the prevalence studies of CVD risk factors amongst Iranians in order to have a reliable estimate on the prevalence of these risk factors and also to identify reliable Iranian studies (see results in chapter four). Based on the comment was given by one of the panellists in the annual review session of my study (Dr Jackie Price) matching design was applied to see whether there are any major differences between Iranian migrants in Edinburgh with Iranian indigenous and Scottish White population regarding the prevalence of CVD risk factors.

Therefore due to the small number of available cases relative to the number of available controls and in order to improve efficiency of comparisons multiple matched controls (1:5) were selected where possible otherwise variable numbers of controls (maximum 5) matched to each case. Thus raw data from a comprehensive study in Scotland (519) and one from Iran (416) were requested for analysis. Scottish Health Survey was also selected as one of the key surveys and data collection technique in this study was modelled on that.

5.5.1 Study Sample

5.5.1.1 Inclusion criteria

Healthy and free-living (not living in institutions) Iranians including people already diagnosed with a CVD aged 18 years or older were included in the study. Those who

had at least one of the inclusion criteria but reside in the UK temporarily (not permanent residents) were excluded from the study. Those students who were resident in Edinburgh for more than five years also were included in this study.

5.5.1.2 Sample size

One of the objectives of this pilot study was to collect initial data to make possible a reliable sample size calculation in any future large scale study. Results of a census was held in Scotland in April 2001 (520) indicated that the number of Iranians who were born in Iran and reside in Scotland was 1588 (1017 males and 571 females) of whom 388 (257 males and 131 females) were residents of Edinburgh. Among those Iranians living in Edinburgh 355 (236 males and 119 females) were over 15 years old. A pragmatic approach was applied to determine the sample size in this pilot study regarding the feasibility issues (time, cost) (521) Therefore bringing in mind the number of Iranian males relative to the females in Edinburgh it was decided to include about (50-100) of them in this pilot study depending on progress in recruitment of eligible subjects.

5.5.1.3 Sampling method

Since there was not a representative sampling frame of Iranians in Edinburgh and they were broadly scattered within the larger community it was not possible to easily access them through other more reliable sampling methods. Consequently, multi-method sampling strategy including snowball sampling had been used to recruit them into this pilot study.

5.5.1.4 Publicising study project among Iranians living in Edinburgh

A leaflet was produced in both English (Appendix 15) and Persian version (an electronic copy is provided in the attached CD to the back cover of the thesis) to publicise the study among Iranians living in Edinburgh. Several copies of this leaflet were distributed in places such as local shops (to be known to provide Iranian food stuff or owned by an Iranian), restaurants (owned and managed by Iranians), Iranian school (active only in Saturdays to teach Persian to Iranian children) and the Edinburgh's central mosque. Also several original and translated versions of this leaflet were

distributed among known Iranians to be redistributed by them among their friends or family members.

Information about this study and my contact details also were advertised (in English and Persian) in a quarterly newsletter (Shirin) which was publishing by the Persian Society of the University of Edinburgh. This study was also advertised in English through a 10 minutes radio programme from the local Muslim radio station which was broadcasting in the holy month of Ramadan (Radio Ramadan).

The leaflet also was distributed in different occasions when Iranians informally gathered together to celebrate e.g. Iranian New Year or to watch an Iranian film together.

5.5.1.5 Initiating the primary contacts and approaching potential participants

I explained among the small circle of Iranian friends the study objectives and procedures I am going to do on the study participants. Advantages of participation in this study were emphasised and they were requested to introduce this study to their friends or relatives and give my contact details to whom that show interest for participation. After receiving contact details of potentially interested people they were contacted by phone or sending email or text message. At this stage a brief explanation about the study objectives was given and a convenient appointment time was settled for them. Those attending the study clinic were also asked to encourage their friends or family members to participate in the study.

5.5.2 Study variables

Studied variables in this pilot study can be classified in four groups as follow:

Baseline variables: age, sex, self-declared nationality, country of birth, length of stay in UK, length of stay outside Iran and parents' country of birth.

Variables relating to the study setting and participants' concerns: preferred language, successful ways of reaching Iranians, willingness to allow their name and contact details to go on a list of Iranians, willingness to share their family and friends' contact details, factors affecting their participation (religion, ethnic characteristic, sex, age or any other aspect of the study researcher or interviewer), preference in relation to

the gender of practitioner, method of questioning, any other factors affecting their participation, feeling about study questionnaire and questions (the time questions took, being easy to understand or too sensitive), self-declared religion, idea about Iranians' willingness to explore their religion, considering question about religion too sensitive, suggestions to improve Iranians participation in health studies, data collection method and place, language of interview, the questionnaire completing method, the questionnaire completion status, consenting to give blood sample for analysis and storage, consenting to allow their GP to be informed about participation in this study and to receive a copy of results from their blood sample analysis.

CVD risk factors: Physical inactivity, unhealthy eating habits, smoking, excessive use of alcoholic drinks, poor economic condition, low educational status, familial history of CVD, hypertension, raised level of total cholesterol, LDL-C or triglycerides, low HDL-C level, general obesity, high waist to hip ratio, diabetes.

Cardiovascular conditions: Angina, heart attack, heart murmur, abnormal heart rhythm, other heart trouble, stroke, ischaemic heart disease (IHD).

In order to make the results section easy to follow, the applied definition(s) for each of the studied CVD risk factors is/are provided separately before providing the findings with regard to every individual risk factor in chapter 7.

5.5.3 Method of data collection

5.5.3.1 Protocol for measurement of anthropometric indices

In order to measure anthropometric indices (weight, height, waist and hip circumference) accurately the Standard Operating Procedures (SOP) followed by the practitioners in the Wellcome Trust Clinical Research Facility (WTCRF) were adopted (Appendix 16: weight measurement, Appendix 17: height measurement, Appendix 18: waist and hip measurement).

To measure weight a digital scale (SECA 797) was used and all study participants were asked to remove outdoor clothing, their shoes and any heavy items in pockets. Then they were requested to stand on scales and instructed to keep still while their

weight was been measured. Weight was recorded and analysed in kilogram (kg) to the nearest 0.1 kg in this study.

In order to measure height the study participants were asked to remove their shoes and stand in an unsupported position with their legs straight, their heels, head and shoulder blades touching the wall or vertical scale and their feet parallel to each other. In this position and to have an accurate measurement toes should point forward and soles should positioned flat on the floor. All participants were also asked to stand as tall as possible and look straight ahead with head and eyes in Frankfurt plain position (it is an anatomical position of the human skull referring to a position in which a presumptive line passing through the inferior margin of the left orbit and the upper margin of each ear canal is parallel to the surface of earth. This position is recommended at the World Congress on Anthropology in Frankfurt, Germany in 1884 to be considered in height measurements). (522) The horizontal measure blade then was brought down to touch the top of subject's head. All height values were read on the vertical scale to the nearest 0.1 centimetre and recorded in metre.

5.5.3.2 Protocol for measurement of blood pressure

To reduce inter and intra observer variation a digital sphygmomanometer was applied in this study to measure study participants' blood pressure. Thus calibrated Omron 705IT monitor was used to measure the subjects' blood pressure twice with at least 10 minutes interval. The measurements were done by qualified nurses in the study site (WTCRF - Edinburgh's Western General Hospital).

Every participant was explained on his/her arrival objectives of the study and also the measurements procedure. Then they were asked to read the study information sheets and sign consent forms. A copy of the study information sheet along with signed consent forms were given to the participant for their future study. They were advised that to have an accurate blood pressure measurement he/she should sit quietly for five minutes to rest. They also were requested not to eat or drink during this time and were warned that during the measurement the cuff will inflate and they may feel some pressure on their arm during the procedure. All study participants were requested to sit in a comfortable chair in a private room and a pillow was offered to support their right arm at a level to

bring their elbow to approximately heart level. Then they were asked to sit in a comfortable position with legs uncrossed and feet flat on the floor. A standard adult size cuff was applied round the upper right arm (about 2 cm above the elbow crease) and left arm was used only if it was impossible to use the right arm for the measurement. The cuff was applied neither tightly nor loosely so that it was possible to insert two fingers between cuff and arm. Blood pressure measurement was repeated after ten minutes for each participant. Values both for diastolic and systolic blood pressure were recorded on the data sheet which had been prepared for this purpose. The Standard Operating Procedure (SOP) for application of Omron 705IT monitor was followed in this study to measure the participants' blood pressure (Appendix 19).

5.5.3.3 Protocol for blood sampling, processing and storage

Blood samples were obtained by the nurses from those study participants that consented to give their blood samples for lipids and glucose analysis and also for long term storage to use in future possible studies. These samples were directly sent to the study site laboratory for analysis and those for storage were spun immediately and then classified and stored in separate boxes temporarily in the study site freezer (-40° C) and then for long term storage (-80° C) they were transferred to the Queen's Medical Research Institute at the Royal Infirmary of Edinburgh.

Blood sampling regime for analysis and storage purposes was determined after consultation with Professor Rudolph Riemersma (senior lecturer in cardiac biochemistry and professor of medical physiology in Vascular Injury & Cardiology Unit of the University of Edinburgh) (Table 5.1).

5.6 Data collection

Data collection stages of the study were planned to take place in the study site. Those participants who had not time to stay in the study site after anthropometric measurements and blood sampling there was an opportunity to be interviewed in their home or any other preferred place. An appointment time between 9^{AM} – 3^{PM} was given during week days to people who showed their interest to participate in the study (e.g. by telephone call or sending message). Participants were allowed to select the interview language (Persian, English, Azeri Turkish) of their choice.

Table 5.1 Blood sampling regime in the pilot study of the prevalence of cardiovascular risk factors among Iranians in Edinburgh.

Blood sample	Tube	Spin speed/Time	Instructions	Storage
Lipid profile	Serum gel 4.9 ml	NA [*]	Send to lab	Send to lab
Glucose	Fluoride 2.9 ml	NA	Send to lab	Send to lab
Whole blood	EDTA ^{**} 4.9 ml	NA	NA	-80° C Freezer
Insulin, CRP [†]	EDTA 9 ml	1000g/15 mins/4° C spin within 30 mins	Pipette into 4 aliquots (400uls per aliquot)	-80° C Freezer
Cytokines, Adiponectin	EDTA 9 ml	1000g/15 mins/4° C spin within 30 mins	Pipette into 6 aliquots (600uls per aliquot)	-80° C Freezer
Homocysteine	EDTA 9 ml [‡]	1000g/15 mins/4° C spin within 20 mins	Pipette into 3 aliquots (Plasma and Buffy coat) (1000uls per aliquot)	-80° C Freezer
CD40L [±] , Fibrinogen	Citrate 3 ml x 2	1000g/15 mins/4° C spin within 30 mins	Pipette into 4 aliquots (400uls per aliquot)	-80° C Freezer
C-peptide	Serum 9 ml	Stand for 2 hours then 1000g/15 mins/4° C	Pipette into 4 aliquots (400uls per aliquot)	-80° C Freezer

* Not applicable.

** Ethylene Diamine Tetra-acetic Acid: is used as an anticoagulant agent in the blood sampling tubes.

† C-reactive protein. ‡ Tubes to be pre-cooled on ice.

±CD40L is a ligand of CD40 (activation protein related to tumor necrosis factor) and both increase simultaneously with atherosclerotic lesions.

They also were allowed to select the language of consent forms, study information sheet and interview questionnaires (from an original English or translated Persian versions).

5.6.1 Study questionnaire testing in the pre-pilot phase

To be sure that those potential study participants will understand all questions in the original and translated versions of the questionnaire and supporting documents they were checked by one of the study supervisors (Dr Farshid Namdaran) who was fluent in English and Persian as his mother language. Also the questionnaire and its adjoining documents were tested before start of the pilot study in pre-pilot phase. Therefore four questionnaires were filled and based on the respondents feedback very minor changes were done in the content of questions or open ended answers within the study questionnaire (e.g. in the alcohol drinking module the number of questions were reduced and questions were focused on drinking or not drinking of alcoholic beverages and frequency of drinking rather than the type of drinks).

5.6.2 The interviews, measurements and sampling

Wellcome Trust Clinical Research Facility (WTCRF) based in the Edinburgh's Western General Hospital was selected as the study site. Officials in the WTCRF accepted to provide space and instruments and also research nurse staff at a subsidise rate.

Complete information about the study objectives and the procedure were given to the study participants on their arrival. They were advised to ask any question(s) they might have about the study or the procedures. Then they were given consent forms in three copies with a study information sheet to study and sign (Appendix 20) (an electronic copy of the Persian version is provided in the attached CD to the back cover of the thesis). A copy of the signed consent form along with the study information sheet was given to the participants to keep for future study. Another copy was filed in the study site and the third copy was kept by the study investigator. The process of studying and signing consent forms, blood pressure and anthropometric measurements, blood sampling and interview took between 60-80 minutes.

The study participants were interviewed about their CVD related life style e.g. physical activity, smoking habit and diet. They also examined for anthropometric indices

and their blood sample were analysed for certain biochemical factors (TC, HDL, LDL, and Glucose). Waist and hip circumference of all female participants were measured twice by a female nurse assistant and of the male participants by me or a nurse assistant in a private room. Mean values of two measurements were used in the analysis. If the difference between two measurements was more than 0.5 centimetre a third measurement was performed and two close values were selected for analysis. Height was measured to the nearest 1 cm and weight to the nearest 0.1 kg.

For those participants who were not able to attend the study place telephone interview, postal questionnaire or interview in their homes were offered. Afterwards they were asked to nominate and facilitate introductions to other people whom they know and who fulfil the study criteria. In the later phase the introduced nominee was contacted for participation in the study again with giving detailed information about objectives and stages of the study.

Based on the participants' permission a copy of their blood sample analysis' results attached to an information sheet (to describe the meaning of normal and abnormal values) were sent to their address and another copy to their GPs.

5.6.3 Inter and intra-observer measurement variation

To ensure accuracy of waist and hip measurements and to reduce intra-observer variation I attended along with other research nurse assistants in a practical training session which was planned by the WTCRF in the study site. There was opportunity in this training program to check for measurement variation between different measurers and to correct measurement method according to the standards.

5.7 Ethical considerations

In this pilot study all participants was given choice to give blood sample only for lipids and glucose analysis, for storage purposes simultaneously or refuse to give blood sample at all. Verbal explanation about the study, its objectives and stages of procedures was provided for all participants on their arrival. But at the same time to ensure rigor and prevent potential misunderstandings they were given both Persian and English version of the study information sheet attached to the consent forms. All study participants were asked to read the study information sheet which was prepared to give information about

the study, the participants' legal rights if something goes wrong and organisations that funded the study. It was emphasised that no one will have access to the information they will provide in this study without their prior permission. No names were written on the study questionnaires and all participants were allocated a code. So it was not possible to detect the name of respondents from the questionnaires or examinations result forms. All names and contact details also were filed separately from the questionnaires and the participants coding lists. The study participants were offered a cup of tea or coffee with biscuits after giving blood sample. They also were offered five pounds as compensation to cover a part of their travel costs to and from the study site.

5.8 Process of data request from Scottish Health Survey 2003 and an exemplar study from Iran for comparison purposes

To compare findings of this pilot study with the results of exemplar studies in Iran and also in Scotland data from two major studies were decided to be used for comparison purposes. Tehran Lipid and Glucose Study (TLGS) from Iran (416) and Scottish Health Survey 2003 (519) were the selected studies. The process of getting data of the Iranian study took several months (August-December 2007) and the data from Scottish Health Survey were obtained from the statistics unit of Scottish Government about 16 hours after the submission of data inquiry.

5.9 Data analysis

5.9.1 Data coding and extraction

Data coding was mainly adopted from the coding system that was used in the Scottish Health Survey and thus almost similar codes were applied to label the study variables, missing values and non-numeric data. SPSS version 14 had been used to create data extraction sheet and data were manually entered to the extraction sheets.

5.9.2 Data entry

Data entry was performed by me after checking each individual questionnaire for mismatches and missing. If there was any mismatch in the responses it was corrected by referring to the related questions or by contacting the respondents for clarification. All

continuous variables were entered as they were reported (e.g. age) or measured (e.g. systolic and diastolic blood pressure) and where possible with two digit decimals. Responses to open ended questions were extracted separately for each question and they were categorised in different groups and a code was allocated to each group. Thus open-ended questions were analysed as nominal variables.

5.9.2.1 Quality control of data entry: Visual record verification check of the data

Visual record verification check of the data was applied to correct any discrepancies in the electronic file resulting from errors in the initial data entry. Every outlier in the variables was checked on the original questionnaire and laboratory report sheets and if they were proved to be true, they were used in the analysis. In the case of missing information for a single variable of the study, subjects were excluded only from the analysis of that variable. To increase robustness of analysis and to maximise possibility of using parametric methods in the analysis, application of imputation technique for missing values (median imputation) was also decided to be considered if the number of missing values for each variable exceeds 10%. However; in practice imputation was not performed since the number of missing values for each variable was not reached to the 10% level.

5.9.2.2 Statistical methods used in data analysis

There is no statistical theory behind analysis of non-random data. But since one of the objectives of this pilot study was to learn lessons and develop methods to conduct a future population based study, the study data were analysed statistically assuming that they were collected randomly. Therefore, application of these methods can be considered in the future large scale study. With this background basic characteristics of the studied sample were described by absolute and relative frequencies and no further statistical analyses were performed on these data. To indicate prevalence of CVD risk factors and CVD conditions in the study sample and also Iranian exemplar population in comparison to the baseline population (Scottish general White population) mean, mean difference and its confidence interval or geometric mean and exponential confidence interval, exponential geometric mean difference for continuous variables and prevalence

rate ratio with confidence interval for dichotomous variables were calculated. To see whether any possible differences between these three samples were statistically significant straightforward comparison method has been applied primarily by ignoring matching criteria and thus conventional methods like analysis of variance (Anova) were applied where possible. To test distribution of continuous quantitative variables for normality Q-Q plot and if necessary Kolmogorov-Smirnov test (without Lilliefors significance correction) was applied. Also when the assumption of normality in the original data set was violated, logarithmic or power transformation was used to overcome the issue where possible.

Conditional logistic regression model was also applied in order to analyse the binary data in matched groups to see whether its use can change analysis results in practice. STROBE (The checklist to Strengthen the Reporting of Observational studies in Epidemiology) (523) statement guideline was applied to report data analysis results.

Multiple test adjustment to correct experimentwise error (ER) (524) (probability of rejecting at least one of the independent null hypotheses that are conducted in a study when in fact they are true) was an issue of concern in this pilot study because of the multiplicity of measured outcomes and thus number of needed hypotheses testing in the comparison groups. The logic behind the recommended adjustment for multiple testing is that when performing a significance test at 95% confidence level there is a chance to observe one coincidental false significant result in every 20 performed test. (525, 526) Opponents of multiple test adjustment have raised several questions and suggested that no statistical theory provides answer to their questions. (526) One of the main objection is that with reducing the chance of making type I error, the chance of making type II error increases. Increasing of testing confidence level (99%) can reduce ER rate which also needs a larger sample size. (526) Due to the small sample size of the recruited Iranians and exploratory nature of this pilot study it was decided to analyse data at 95% confidence level (without application of multiple test adjustment) and to provide results of all performed comparisons.

5.10 Summary

Due to a few empirical data on the Iranian Diaspora with regard to the prevalence of CVD risk factors, calculation of an overall summary estimate from the reported prevalence rates of CVD risk factor in this ethnic group is not possible. A proposal was set out to do a pilot study on the prevalence of major cardiovascular disease (CVD) risk factors amongst Iranians living in Edinburgh. As the first study on Iranian migrants in the UK, the results will inform future large scale research.

Multi-method sampling technique was used to recruit healthy and free-living Iranians aged ≥ 18 years into this pilot study. One to many (1:5) matching design was applied to compare the collected data in this pilot study with the obtained data from two exemplar studies among Iranian indigenous and Scottish White population regarding the prevalence of CVD risk factors. Main variables included physical inactivity, smoking, hypertension, overweight, obesity, hyperlipidaemia and diabetes. Concerns of the Iranian migrants to participate in a study of this kind also were examined. Mean, mean difference (95% CI) to describe continuous variables and prevalence rate ratio (95% CI) for dichotomous variables were applied. Conventional methods (e.g. ANOVA) and also conditional logistic regression model was used to test the observed differences between the comparison groups.

Findings of this pilot study are provided in the next two chapters. General characteristics of the study participants, their concerns to participate in a study of this kind and prevalence of the CVD risk factors in this ethnic minority group are discussed in chapter six. In chapter seven CVD risk status of the Iranian migrants compared to Iranian indigenous and also Scottish general White population are explained.

Chapter Six: Lessons learnt from the field work: a pilot study of the prevalence of established cardiovascular disease risk factors among Iranians in Edinburgh

6.1 Introduction

Methodology of this pilot study was described in the previous chapter (page 135-150). Findings of the pilot work in relation to the characteristics of the participants, their views about the study itself and also about the applied questionnaire, language used and method of questioning are provided in this chapter. The respondents' concerns to participate in a study of this kind, to give blood for analysis and long term storage and also their preference with regard to the gender of practitioner who examine them and reservation to answer questions about religion and economic status are also discussed. Major focus of this chapter is on issues reflecting possibility of using the applied methodology in a similar future large scale study on Iranian migrants. Other findings related to the prevalence of CVD risk factors all are indicated in the next chapter.

6.2 Demographic and other baseline characteristics of the study sample

Recruitment stage of this pilot study was started from 29/08/2006 and continued until 15/06/2007 during which a total of 72 people (49 males and 23 females) aged 18 and over were examined for cardiovascular risk factors. Mean age and age range of the study participants were shown in Table 6.1 compared with the Scotland 2001 Census data about Iranians. (520) Numbers of the recruited people in both sexes and in different

age groups compared to the numbers of Iranians in Edinburgh according to the Scotland 2001 census data were also indicated in Table 6.2.

Table 6.1 Mean age and age range of the recruited Iranians aged 18 compared to the Edinburgh's Iranian population based on the Scotland 2001 census data.

Sex	Recruited Iranians in this study		Iranians in Edinburgh (Scotland 2001 Census data)		Mean difference 95% CI
	n	Mean age (age range)	n	Mean age (age range)	
Male	49	47.7 (29-64)	231	41.1 (18-71)	6.6 (4.9-8.2)
Female	23	44.2 (30-71)	115	37.8 (18-80)	6.4 (5.6-8.1)
Total	72	46.6 (29-71)	346	40.0 (18-80)	6.6 (5-8.1)

Table 6.2 Age distribution of recruited Iranians in this pilot study and Iranians in Edinburgh by sex according to the Scotland 2001 census data.

Age groups	Iranians in Edinburgh * Scotland 2001 Census data		Recruited Iranians in this study	
			Number (%)	
21 to 30				
Male	23 (10.2)		2 (4.1)	
Female	29 (26.4)		1 (4.3)	
Total	52 (15.5)		3 (4.2)	
31 to 40				
Male	65 (28.9)		8 (16.3)	
Female	41 (37.3)		6 (26.1)	
Total	106 (31.6)		14 (19.4)	
41 to 50				
Male	111 (49.3)		21 (42.9)	
Female	24 (21.8)		12 (52.2)	
Total	135 (40.3)		33 (45.8)	
51 to 60				
Male	19 (8.5)		16 (32.6)	
Female	10 (9.1)		3 (13.1)	
Total	29 (8.7)		19 (26.4)	
61 and over				
Male	7 (3.1)		2 (4.1)	
Female	6 (5.4)		1 (4.3)	
Total	13 (3.9)		3 (4.2)	
Total				
Male	225 (100)		49 (100)	
Female	110 (100)		23 (100)	
Total	335 (100)		72 (100)	

* Identified based on the country of birth.

The findings indicated a higher mean age (46.6) of the recruited sample relative to the mean age of the Iranian population who were counted during the Scotland 2001 census.

As shown the mean age in both male and female subgroups was significantly higher in the recruited sample compared to the mean age of Iranian men and women in Edinburgh according to the Scotland 2001 census data. Such a difference might be resulted from a 6 years lag between the Scotland 2001 census data and the date of data collection in this pilot study (2007).

According to the study results men from the age group of > 50 years and women in the age group of 40-60 years are over represented but both males and females from younger age groups are under-represented in the recruited sample.

Country of birth for 71 (98.6%) of the respondents was Iran and only one of the male participants was born in Britain. Place of birth in the former group based on its geographical location within different provinces of Iran relative to the provinces population (527) is provided in Table 6.3.

Table 6.3 Distribution of the recruited study sample by sex and place of birth in different provinces of Iran-2007.

Name of the province	Province population * Number (%) **	Recruited Iranians in this study		
		Male	Female	Total
		Number (%)		
Tehran	13,413,348 (19.0), (23.9)	15 (31.2)	5 (21.9)	20 (28.3)
Khozestan	4,274,979 (6.1), (7.7)	9 (18.7)	4 (17.5)	13 (18.3)
East Azarbaijan	3,603,456 (5.1), (6.5)	5 (10.4)	3 (13.1)	8 (11.3)
Isfahan	4,559,256 (6.5), (8.3)	3 (6.2)	3 (13.1)	6 (8.5)
Razavi Khorasan	5,593,079 (7.9), (10.1)	3 (6.2)	1 (4.3)	4 (5.6)
Gilan	2,404,861 (3.4), (4.4)	1 (2.1)	1 (4.3)	2 (2.8)
Hamadan	1,703,267 (2.4), (3.1)	1 (2.1)	1 (4.3)	2 (2.8)
Markazi	1,349,590 (1.9), (2.5)	2 (4.2)	0	2 (2.8)
Mazandaran	2,920,657 (4.1), (5.3)	1 (2.1)	1 (4.3)	2 (2.8)
Qazvin	1,143,200 (1.6), (2.1)	2 (4.2)	0	2 (1.4)
South Khorasan	636,420 (0.9), (1.2)	2 (4.2)	0	2 (2.8)
West Azarbaijan	2,873,459 (4.1)	1 (2.1)	1 (4.3)	2 (2.8)
Chaharmahal and Bakhtiari	857,910 (1.2), (1.5)	1 (2.1)	0	1 (1.4)
Fars	4,336,878 (6.2), (7.8)	0	1 (4.3)	1 (1.4)
Kerman	2,652,413 (3.8), (4.8)	1 (2.1)	0	1 (1.4)
Kermanshah	1,879,385 (2.7), (3.4)	0	1 (4.3)	1 (1.4)
North Khorasan	811,572 (1.2), (1.4)	0	1 (4.3)	1 (1.4)
Qum	1,040,681 (1.5), (1.9)	1 (2.1)	0	1 (1.4)
Total	56,054,411 (79.5), (100)	48 (100)	23 (100)	71 (100)
Total population of Iran	70,472,846 (100)			

* According to the census 2006.

** Relative to the country population and total population of the representative provinces respectively.

There are currently 30 provinces in Iran and people from 18 provinces had at least one representative in the study sample. As seen in the Figure 6.1 (528) the study participants are originated from different part of Iran but those coming from some of the provinces may be over represented in the sample (e.g. those coming from Khozestan or East Azarbaijan provinces).

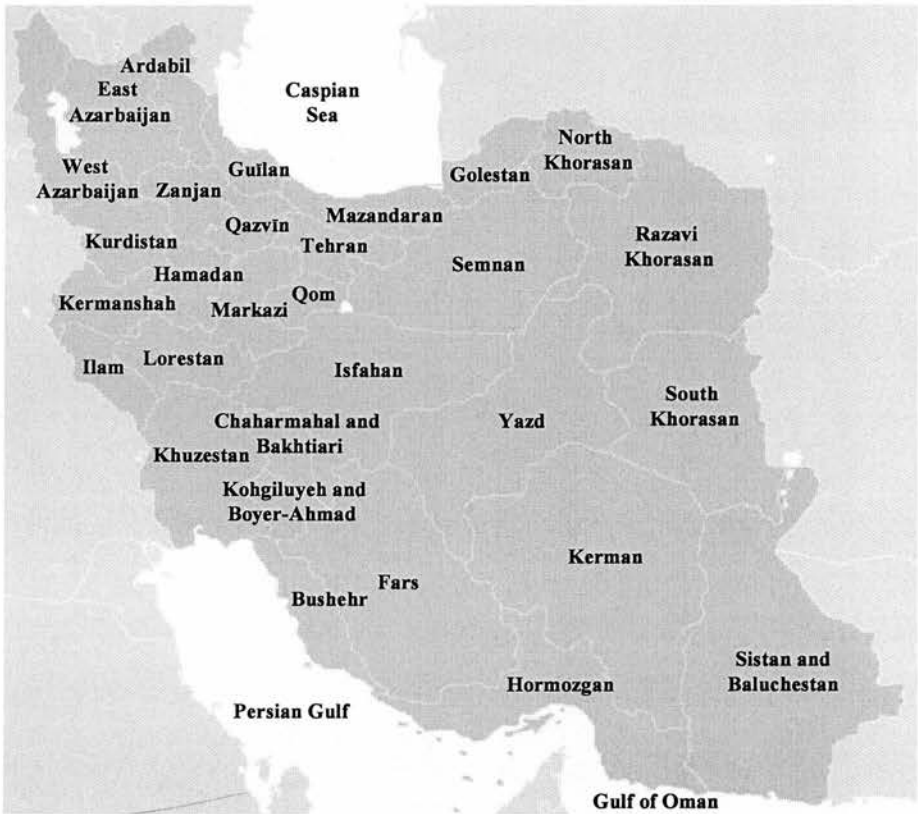


Figure 6.1 Map of Iran and geographical location of its 30 provinces-July 2008

Parents’ birthplace was Iran for 65 (90.3%) of the respondents and 7 people did not answer the question. This shows that most of the study participants were originally Iranian and that they were probably brought up mostly within an Iranian family in which Iranian culture and health-related life style was dominant.

The overall mean length of stay in UK for the study participants was 19.13 (years) (85% CI: 16.63-21.63) with the range of 3-36 years. Average length of stay for Iranian males was 21.86 (95% CI: 18.98-24.73) in the range of 5.1-36 years and for females it was 13.32 (95% CI: 9.1-17.54) in the range of 3-36 years. Findings of this study

revealed that Iranian males have migrated to UK several years earlier than females (mean difference: 8.54 years, 95% 3.53-13.55) but effect of small sample size in the interpretation of these results should not be disregarded.

General characteristics of the studied sample were shown in Table 6.4. While 98.6% of respondents were born in Iran only in 73.6% of cases, self-declared ethnicity was Iranian. Three options were available to be chosen in the applied questionnaire to declare the ethnic group. Thus 25% have introduced themselves as mixed British-Iranian and 1.4% have chosen the “others” option. A number of interviewees from two later subgroups of informants, while answering the question referred also to the presence of a degree of scepticism among Iranians in relation to the question and the fact that some Iranians may respond to this question conservatively due to reasons like fear of discrimination against ethnic minorities in the host community.

Table 6.4 General characteristics of the studied sample of Iranians living in Edinburgh-2007.

Baseline variables	Male n= 49	Female n= 23	Total n= 72
	Number (%)		
Self reported racial or ethnic group			
Iranian	36 (73.5)	17 (73.9)	53 (73.6)
Mixed British-Iranian	13 (26.5)	5 (21.7)	18 (25.0)
Others: British	0	1 (4.4)	1 (1.4)
Country of birth			
Iran	48 (98.0)	23 (100)	71 (98.6)
UK	1 (2.0)	0	1 (1.4)
Other	0	0	0
Occupation *			
Managerial & professional	10 (20.4)	1 (4.4)	11 (15.3)
Intermediate	9 (18.4)	0	9 (12.5)
Small employers & own account workers	5 (10.2)	8 (34.7)	13 (18.1)
Lower supervisory & technical	13 (26.5)	1 (4.4)	14 (19.4)
Semi-routine & routine	5 (10.2)	4 (17.4)	9 (12.5)
Not employed: looking after home & family or retired	7 (14.3)	9 (39.1)	16 (22.2)
Education			
MSc (MA) or PhD	11 (22.5)	3 (13.1)	14 (19.5)
BSc	17 (34.7)	6 (26.1)	23 (31.9)
College degree/SCE Higher/CSYS/A-Level or diploma	16 (32.6)	12 (52.2)	28 (38.9)
Lower grades than SCE/CSYS/A-Level or diploma	1 (2.0)	1 (4.3)	2 (2.8)
Other	4 (8.2)	1 (4.3)	5 (6.9)

* Classification was drawn from socio-economic classification in the Scottish Health Survey.

It was not possible to judge the claim in this pilot study since any discussion needs to be based on sound evidence which can be achieved for instance through an in-depth interview.

Self-declared religion of the study respondents was indicated in Table 6.5. Formally more than 99.4% of Iran's population are Muslim. (529) In this study 16.7% (7 males and 5 females) of respondents considered questions about religion offensive and 2.8% made no comment. On the other hand 54.2% of all participants (21 males and 18 females) stated that Iranians generally are not interested to clarify their religion in a future similar study. When respondents in the later group were asked for the reason of not being interested to clarify their religion in studies of this kind, 43.6% made no comment and 56.4% (13 males and 9 females) stated that because of social pressure against religious minority groups they prefer to respond this question conservatively. The findings suggest that given answers to a single and direct question about religion can be potentially misleading in the Iranian community and that such answers should be interpreted with caution.

Table 6.5 Distribution of the recruited sample of Iranians in Edinburgh by religion (2007) compared to the Scotland 2001 Census data.

Religion	Recruited Iranians in this study			Iranians in Edinburgh (Scotland 2001 Census data)
	Male	Female	Total	
	Number (%)			
Muslim	39 (79.6)	17 (73.9)	56 (77.8)	254 (65.5)
Zoroastrian	1 (2.0)	0	1 (1.4)	NP *
Christian	0	1 (4.3)	1 (1.4)	18 (4.6)
Jew	0	0	0	1 (0.3)
Baha'i	1 (2.0)	1 (4.3)	2 (2.8)	NP
Other	4 (8.2)	1 (4.3)	5 (6.9)	12 (3.1)
None	4 (8.2)	2 (8.7)	6 (8.3)	72 (18.5)
Not stated	0	1 (4.3)	1 (1.4)	31 (8.0)
Total	49 (100)	23 (100)	72 (100)	388 (100)

* Not provided.

6.3 Participants ideas about the study and questionnaire

Views of studied Iranians about successful ways of reaching Iranians and their willingness to give their contact details for recording purposes in order to be contacted

in any future health study were shown in Table 6.6. Word of mouth, advertising in media, participation in the Iranians' informal gatherings and reaching people through those friends who already consented to participate in a study were suggested to be the most suitable way of reaching Iranians. In total 87.5% of all participants were interested to give their own and 79.2% of their family members' or friends' contact details (with their permission) to be recorded for invitation in a possible future study.

Table 6.6 Views of Iranian migrants in Edinburgh on the successful ways of reaching Iranians and their willingness to be recruited in a similar future study-2007.

Question (open ended)	Male	Female	Total
	n= 49	n= 23	n= 72
	Number (%)		
What do you think would be successful ways of reaching Iranians in Edinburgh for studies of this kind? *			
Electoral list	0	1 (4.4)	1 (1.4)
Local phone books	0	0	0
Iranian well known people	1 (2.0)	0	1 (1.4)
Iranian local shop owners	1 (2.0)	0	1 (1.4)
Word of mouth	12 (24.5)	3 (13.0)	15 (20.8)
Advertising in media	8 (16.3)	4 (17.4)	12 (16.7)
Iranian communities	2 (4.1)	3 (13.0)	5 (6.9)
Participating in Iranian informal gatherings	10 (20.4)	5 (21.7)	15 (20.8)
Friends	12 (24.5)	3 (13.0)	15 (20.8)
Other	0	2 (8.7)	2 (2.8)
No comment	14 (28.6)	7 (30.4)	21 (29.2)
Would you willing to allow your name and contact details to go on a list of all Iranians in Scotland for a future health study of this kind?			
Yes	42 (85.7)	21 (91.3)	63 (87.5)
No	7 (14.3)	2 (8.7)	9 (12.5)
Are you willing to share your family and friends' contact details so they can be invited to participate in this study?			
Yes	38 (77.6)	19 (82.6)	57 (79.2)
No	11 (22.5)	4 (17.4)	15 (20.8)

* More than one suggestion was allowed.

The results indicated that construction of a sampling frame of Iranians who live in Edinburgh is feasible and the list which was prepared through this pilot study can be applied to recruit Iranians in future health studies after obtaining their formal consent.

Recruitment process of Iranians in Edinburgh into this pilot study and the number of people have actually participated is indicated in Table 6.7. Since a multi-method approach was utilised in this study to recruit Iranians it was not possible to clarify the number of people who have actually been reached by the radio programme (which was broadcasted to publicise this pilot study) and those who have received the study leaflet or read the advertisement (which was given to invite them for participation). It was also not possible to clarify how many people have been invited among friends or relatives by those who themselves have consented to participate and from those invited people how many refused to participate. Thus it was not possible to calculate participation rate in the pilot study.

Table 6.7 Recruitment process of the Iranians in Edinburgh into this pilot study-2007.

Variable	Male	Female	Total
	Number (%)		
The recruitment process:			
People directly invited by the researcher and:			
Consented to participate	14 (77.8)	4 (22.2)	18 (48.6)*
Refused to participate	7 (46.7)	8 (53.3)	15 (40.5)*
Agreed to participate but not attended	3 (75.0)	1 (25.0)	4 (10.8)*
People introduced by study participants or those who have been reached by the study advertisements	35 (64.8)	19 (35.2)	54 (75.0)**

* Percent relative to the number of people invited directly by the researcher.

** Percent relative to the total number of the study participants.

As shown in Table 6.7 among the study attendees 54 (75.0%) were friends or relatives of those who have participated in the study at the earlier stages or those who have seen or heard the study advertisements. As a limitation to the multi-method sampling approach among this later group it was not possible to identify referral chain. For instance I could not identify exactly how many people have been reached by the study advertisements, how many been contacted by their friends or relatives and overall from those who have been reached by the study advertisement or invited by their friends or relatives how many people refused to participate or attended the study site. It was also not possible to identify connections between the study participants and to clarify who were introduced by whom and to decide whether these advertisements or other factors such as persuasion of friends or relatives were main motivation to participate in the study.

Views of the Iranian migrants in relation to the different choices of applicable methodologies in a future population based health study were shown in Table 6.8. Majority of the respondents (76.4%) stated that a face to face interview is their preferred questioning method. The second most preferred questioning method (12.5%) reported to be self completion of a paper or an electronic version of the study questionnaire. But female participants gave equal weight to self completion of a paper or an electronic questionnaire and also an online interview.

Table 6.8 Preferred choices of methodologies by Iranians in Edinburgh to be used in a future population based health study–2007.

Question (open ended)	Male n= 49	Female n= 23	Total n= 72
	Number (%)		
Which method of questioning might increase your participation in similar health studies?			
Face to face interview	35 (71.4)	20 (87.0)	55 (76.4)
Self completion paper questionnaire	4 (8.2)	1 (4.3)	5 (6.9)
Self completion electronic questionnaire	3 (6.1)	1 (4.3)	4 (5.6)
On line internet interview	1 (2.0)	1 (4.3)	2 (2.8)
Telephone interview	1 (2.0)	0	1 (1.4)
No difference	5 (10.2)	0	5 (6.9)
What is your preference in relation to the gender of practitioner who examines or assesses you physically?			
Same gender in all kinds of examinations	1 (2.0)	4 (17.4)	5 (6.9)
Opposite gender in all kinds of examinations	2 (4.1)	3 (13.0)	5 (6.9)
Same gender in examinations of private areas	13 (26.5)	8 (34.8)	21 (29.2)
No preferences about gender of practitioner	33 (67.3)	8 (34.8)	41 (56.9)
Would you agree for your blood sample be stored for further analysis in the future for other CVD risk factors?			
Analysis and storage	45 (91.8)	22 (95.7)	67 (93.1)
Only for analysis	4 (8.2)	1 (4.3)	5 (6.9)
In which language would you prefer the questionnaire or interview in future similar studies?			
Persian	19 (38.8)	13 (56.5)	32 (44.4)
English	13 (26.5)	3 (13.0)	16 (22.2)
Persian or English	17 (34.7)	7 (30.4)	24 (33.3)

According to the findings about 28.5% of men and 52.2% of women prefer practitioner of same gender in all kind of examination or examination of private areas. So it will be important to provide freedom of choice for Iranians to select practitioners'

gender in future studies that involve physical examinations (including waist and hip measurements especially in the female subgroup).

There was a choice in the consent form of this pilot study to show whether every individual participant agrees to give blood sample for long term storage or not. More than 93% of the study participants agreed to give extra blood to be used in a CVD related future study. This rate indicated that most of the Iranians in Edinburgh are generally cooperative with the health studies and have no special reservation in this regard. Moreover I realised that most of the study participants especially men have a positive approach towards blood giving by considering it as a helpful procedure for their own health.

The participants were also asked about their preferred language of a study questionnaire or interview in future. Although about a third of them stated that an original English or translated Persian questionnaire or interview is same for them but almost 45% told they prefer Persian as the language of interview or a printed questionnaire. This is while about 22% of the study respondents selected English language as their preferred language of interview or a printed questionnaire in future.

There were options for the study participants in this pilot study to choose from original English or translated Persian questionnaire and other study documents and also to be interviewed in English or in Persian or Azeri Turkish which is the second most spoken language of the country.

As indicated in Table 6.9 for 93.1% of cases a translated questionnaire was used to ask about their CVD related life styles. Persian was selected by 40.3% of respondents as the language of interview, Azeri Turkish by 11.1% of them and English by only 1.4% of the participants. In 47.2% of cases more than one language (English-Persian, Persian-Azeri Turkish or English-Azeri Turkish) was used in the interview. Most of the interviews (95.8%) have taken place in the study site which was an indication of Iranians willingness to spend time and money from their home or work place to travel to the study site. Although a £5 banknote was offered to all participants for compensation of their travel costs but I believe it had not considerable effect on the participants' decision to attend the study site. Those who were interviewed in their home mostly had young

children and so could not spend much time to stay at the study site after clinical measurements and blood sampling. Due to the limitations in working hours of the study clinic all measurements and interview sessions were planned from 9am to 3.5pm. There were contacts from some of the Iranians in Edinburgh to indicate their willingness to come and participate in the study during weekends or after 5 pm. Also there were several contacts by Iranians residing in nearby small cities (e.g. Livingstone, Dunfermline, Dalgety Bay) but since only Iranians in Edinburgh were target group of this pilot study they were not recruited.

Table 6.9 Preferences and views of the Iranian migrants in Edinburgh about the choices of languages and place of interview in this pilot study-2007.

Variables	Male n= 49	Female n= 23	Total n= 72
	Number (%)		
Interview language			
Persian	15 (30.6)	14 (60.9)	29 (40.3)
Azeri Turkish	6 (12.2)	2 (8.7)	8 (11.1)
English	1 (2.0)	0	1 (1.4)
Mixed of the two or three languages	27 (55.1)	7 (30.4)	34 (47.2)
Language of the questionnaire used			
English version	4 (8.2)	1 (4.3)	5 (6.9)
Translated version	45 (91.8)	22 (95.7)	67 (93.1)
Interview place			
Study site	48 (98.0)	21 (91.3)	69 (95.8)
Participants home	1 (2.0)	2 (8.7)	3 (4.2)

The average time to explain the study objectives, to sign consent forms, measure anthropometric indices and blood pressure, blood sampling and interview was about 60 minutes. In relation to the amount of time questions took in the study, majority of the participants (95.8%) told the time was about right (Table 6.10). Only a few of the study respondents have reported some of the questions in the questionnaire sensitive (question about religion, economic status and alcohol drinking) but almost 99% suggested that the questions were easy to understand.

6.4 Discussion

From the eligible adult Iranian migrants (aged 18 and over) in Edinburgh (346 Iranians were aged 18 and over based on the available data from Scotland 2001 Census data),

20.8% were recruited which included 21.2% of males (n=231) and 20% of females (n=115) (Table 6.1). Recruitment of the study participants took about 9 months which means in average 2 people were recruited each week during this period of time. The recruitment process of course interrupted during 2007 January holidays and Iranian New Year period (18-31 March 2007).

Table 6.10 Views of the Iranian migrants in Edinburgh about the length of study interview and applied questions-2007.

Variables	Male n= 49	Female n= 23	Total n= 72
	Number (%)		
How did you feel about the time questions took in this interview?			
Too long/taking long time to answer	2 (4.1)	1 (4.3)	3 (4.2)
About right	47 (95.9)	22 (95.7)	69 (95.8)
Too short	0	0	0
Did you find the questions in this interview easy to understand?			
Yes	49 (100)	22 (95.7)	71 (98.6)
No	0	1 (4.3)	1 (1.4)
Did you find any questions in this interview too sensitive to you?			
Yes	1 (2.0)	1 (4.3)	2 (2.8)
No	48 (98.0)	22 (95.7)	70 (97.2)

This relatively long recruitment stage of Iranian migrants in this study can probably justifiable by lack of a sampling frame or limitation in the study site's working hours (during weekdays). As mentioned earlier there were contacts from some of the Iranians in Edinburgh to indicate their willingness to come and participate in the study during weekends or after 5 PM. If such a possibility will be provided in any future study it could boost recruitment process considerably. The long recruitment stage into this pilot study can also be an indication to label Iranian migrants a hard-to-reach ethnic group. Moreover, application of other appropriate recruitment strategies should be considered simultaneously in future similar studies.

Lack of a sampling frame of Iranian migrants' names or addresses in Edinburgh and also not having easily identifiable names that are specific for Iranians, made use of multi-method recruitment strategy inevitable in this pilot study. Thus recruitment

process was based mainly on snowball and convenience sampling method. All efforts were made to expand the primary contacts in order to reach every potential eligible Iranian in Edinburgh to make this sample as inclusive as possible. The recruitment procedure was also boosted by calling friends and those who participated in the study earlier to remind them ongoing process of the recruitment. I attended Iranians informal gatherings and distributed the study leaflets in different occasions. All these attempts I believe were effective in convincing Iranians to participate. Role of key persons (those with extended network of friends) to persuade people to participate were also pivotal in this pilot study.

Prevention of selection bias through inclusion of similar and related cases was one of the main concerns in this pilot work. The recruited people were older than (about 6 years) the average Iranian migrant population in Edinburgh (according to the 2001 census data). The difference between two populations should be interpreted with caution due to small sample size in this pilot study and the fact that the test results may change by increase of sample size. There was also a time lag (6 years) between the date of data collection in this pilot work at 2007 and the census date at 2001 which should be considered important in the interpretation of this difference. Our judgement about age range of the recruited people in this study is based on the number of Iranians were counted during Scotland Census 2001 according to their stated birth place. However, one may question reliability of birth place as a proxy question to determine ethnicity of people in any census including in the Scotland Census 2001. Accordingly for nationals of other countries who just were born in Iran it is probable to be classified as Iranian. The only other proxy question applicable to check this assumption in the Scotland 2001 Census questionnaire was question about religion. The available census data (520) indicated that only 4.6% of respondents that time were Christian (any branch) and only 0.5% of informants were Hindu, Buddhist or Sikh. Unfortunately it was not possible to judge correctly whether these Christians are nationals of other countries who were born in Iran or members of Iranian Christian community (about 0.2% of Iranian population according to the conducted census data in 2006 are Christian). (530) But even if these Christians were non-Iranian citizens of other countries who just were born in Iran, the

Scotland 2001 Census data support the idea that most of the people with Iran stated to be their birth place were originally Iranian and not nationals of other countries.

The overall mean length of stay in UK for the study participants was 19.1 years (95% CI: 16.63-21.63) with the range of 3-36 years and for about 76.4% of the study participant it was more than 7 years. These results can verify representativeness of the study sample from the community of Iranian migrants in Edinburgh however; a robust decision can only be made upon having access to the original data collected in the Scotland 2001 Census which were not provided due to the data protection considerations.

In the age groups of 21-30 and 31-40, number of recruited people was seemingly low relative to the number of Iranians in these age groups based on the Scotland 2001 census data. Over-representation of people in the older age groups who know they are in greater risk or have previous experience of the disease and so are willing to avail themselves to the calls for participation in a CVD risk factor study is very common. (531, 532) Thus people who think they are in greater risk of CVD be volunteer for participation. But lower self perceived threat of the disease in younger people, restrain them from participation. The assumption was not possible to be scrutinised in this pilot study but this is generally a common limitation of reliance on convenience sampling method in population based CVD studies. Recruited sample in this study was not an exemption and to have a better sample structure in any similar future study it is better to consider possibility of applying quota sampling to ensure that study sample include enough number of people from different age and sex groups and is not over-represented by volunteers of some age groups.

Recruited people in this pilot study were from 18 provinces among 30 provinces of Iran which indicates acceptable representation of the sample from original population. But as discussed recruited people from a number of provinces are over represented in the sample which can be explained by size and the structure of Iranian migrant population in Edinburgh. To the best of my knowledge Iranians coming from Khozestan province are a major subgroup of Iranian migrants in Edinburgh. They are mainly those students who were recruited from southern provinces of Iran (including Khozestan) and sent about 40

years ago to Edinburgh by the Iranian Ports and Maritime Organisation to study marine engineering. A considerable number of these students stayed or returned to Edinburgh after graduation for work and now reside in Edinburgh with their extended families. In relation to the over-representation of migrants from East Azarbaijan probably my own ethnic background and network of friends I have from Iranian Azeri people in Edinburgh had some effects in their higher recruitment rate into this study but again with the lack of access to the structure of total Iranian migrants in Edinburgh with regard to their place of birth and residence (by province) before migration, it is very difficult to give a robust explanation for such a over-representation.

Having origin in a special province of Iran may have reflection on the diet and lifestyle of that individual migrant and his/her family. For instance people from the sea-side provinces (in North and South part of Iran) generally have sea foods in their daily diet while people from mountainous area in the North West, West and the central part of the country rarely have fish or other sea foods in their diet. So it is worth to consider such background variations in any future study on the health of Iranian migrants.

Iranian males in the study sample had longer length of stay in UK than females which can be explained by first wave of Iranian male students who have come to Scotland for study but remained in this country for work and married mostly by one of their counterparts in Iran and brought her later to Scotland. This pattern of intermarriage among immigrants in the western countries is common in ethnic minorities. (533-536)

In response to the question about their ethnicity 25% of the respondents have chosen mixed British-Iranian option while 73.6% introduced themselves as Iranian. A number of respondents stated that they prefer to introduce themselves as British when filling formal documents because of a degree of discrimination that they feel exist against ethnic minorities. Such a claim can be a main concern in detecting ethnicity of Iranians who fill a form or answer a question especially when we know only 26.5% of Iranians answered questions about ethnicity correctly (have chosen the "Other" option) in the Scotland 2001 Census (21.4% stated that they are White and 50.5% selected the "Other South Asian" option). (520) Although misunderstanding of the question may have a role in giving incorrect answers but regarding the observed level of literacy among Iranian

migrants in Edinburgh misunderstanding must be ruled out as the main reason for inaccurate answers. So with such a low sensitivity of a single question in detecting ethnicity of Iranians, it is suggested to avoid application of a unique question as a proxy for ethnic classification of Iranian migrants in future studies. This inaccuracy also was seen with question about faith and religion specially when interviewing religious minority groups. Concerns about presence of an institutionalised discrimination against people who practice a special religion and the effects this may have on their legal rights in the host community can prevent people to reveal their faith or religion. Such a reservation also may stem from migrants' previous experiences in relation to the declared religion in another country or country of the origin. Study of association between religion and health related life style is the main purpose of question about religion in health studies. But findings of this study indicate that at least for Iranian migrants, answers to the question will not lead to straightforward answers.

Answers were given by the study respondents about the successful ways of reaching Iranians in Edinburgh to recruit them into health studies reflects challenges researchers may face in accessing Iranians. Only one of the participants stated the electoral list can be used to find Iranian names and no one referred to possibility of using local phone books to identify Iranian names. Lack of a software package to detect Iranian names and family names in the electoral or phone book data bases can lead us to recommend informal methods (word of mouth, participating in Iranians informal gatherings etc) to recruit Iranians into health studies. But use of above mentioned methods can be considered as alternate especially if such software will develop in the future or if the number of all names and family names in a single database will be so small that make hand searching of Iranian names and family names cost effective and feasible.

Face to face interview as the preferred questioning method for most of the informants in this pilot study is relatively an expensive method of data gathering compare to self completion of paper or electronic questionnaires. However its use has some advantages like reliability of answers and possibility of correcting misunderstandings. But regarding amount of time and money which are needed to set up an interview session this method might face certain limitations in practice. Thus in planning a population based health

study to be conducted on Iranian migrants all aspects of data gathering methods including costs should be considered carefully.

Since about 45% of the study respondents selected Persian as their preferred language of interview or study questionnaire in a future similar study application of both English and Persian languages simultaneously in any future large scale study on Iranian migrants is recommended. The study results also suggest that employment of multi-lingual interviewers can increase success rate in recruitment and conducting of a population based study on Iranian ethnic minorities.

Findings of this pilot study indicated that there is no reservation among Iranians in a scale that inhibits them completely from participation in health studies. So it seems that a large scale population based study on Iranian migrants is feasible. The results revealed that the Scottish Health Survey questionnaires can be adapted for the Scottish Iranian population and with its translation into Persian probability of success in conducting a large scale study will be increased.

6.5 Abstract

Introduction: A total of 72 people (49 males and 23 females) aged 18 and over were examined for cardiovascular risk factors in this pilot study. The main objectives were to assess feasibility of a large scale study on Iranian Diaspora and to estimate variability of outcomes to help calculation of sample size in the large scale population based CVD studies.

Results: Recruited people were from 18 provinces among 30 provinces of Iran. Mean age of the studied sample (46.6 years, range 29-71) was about 6 years higher than the mean age of Iranian migrants (40.0 years, range 18-80) were counted in the Scotland 2001 census. Almost 56.9% of the study participants had no preference about the gender of practitioner but 29.2% indicated their preference towards practitioner of same gender in examinations of private areas in future studies. A translated questionnaire was used in 93.1% of cases to clarify CVD related life styles of the respondents. Persian was selected by 40.3%, Azeri Turkish by 11.1%, English by only 1.4% of the participants and in 47.2% of cases more than one language was used as the language of interview. More than 93% of the study participants agreed to give extra blood to be used in a CVD

related future study. Majority of the participants (95.8%) told that the amount of time questions took in the study was about right. Only a few of them have reported that questions about religion, economic status and alcohol drinking are sensitive. Almost 99% suggested that the questions were easy to understand.

Conclusion: Iranian migrants in Edinburgh did not show any reservation to participate in a health study in the future. Construction of a sampling frame of Iranians who live in Edinburgh is feasible and the list which was prepared through this pilot study can be applied to recruit Iranians in future health studies. The findings also revealed that Scottish Health Survey questionnaires can be adapted for the Scottish Iranian population.

In the next chapter results of the pilot work in relation to the prevalence of CVD conditions and major CVD risk factors among Iranians in Edinburgh compared to the Edinburgh's general White population and an exemplar Iranian population will be discussed.

Chapter Seven: Prevalence of the major cardiovascular disease risk factors among Iranians in Edinburgh compared to Iranians in Tehran and Edinburgh's White population

7.1 Introduction

In the two previous chapters the general applied methodology and findings with regard to the characteristics of the study participants and their views about the study and the applied procedures were discussed. In this chapter findings of the pilot study in relation to the prevalence of major cardiovascular disease risk factors are compared with two other age and sex matched data sets: one from Scottish Health Survey 2003 and the other from Tehran Lipid Glucose Study 2002 as an exemplar study from Iran. Main focus of this chapter is to compare prevalence of the CVD risk factors among Iranian migrants in Edinburgh with the Edinburgh's White population and also Iranian indigenous population whenever possible. Planning of an analysis approach for a future large scale study with same study design is also considered in this chapter. Such a comparison is for illustrative purposes only and due to differences between the studies, such comparisons must be interpreted with extreme caution. However, following discussions can shed light on priorities and the way a future large scale study on the health of Iranian migrants can be conducted.

7.2 Statistical analysis method

Since the study subjects were recruited based on a non-random sampling method and bearing in mind that no statistical theory exists for comparisons of the data collected

from a non-random sample with data of a randomly selected sample, in the first instance and for the ease of data analysis and presentation it was decided to compare three comparison groups based on an assumption that the data of this pilot study were produced through a random sampling procedure. Thus conventional statistical methods (by ignoring the matching criteria) were used to analyse and discuss possible differences between the comparison groups.

Mean differences and where appropriate geometric mean differences for quantitative variables and the prevalence rate ratio (PRR) for the dichotomous variables were calculated as the parameters of interest in the analysis. Prevalence proportion ratio (PPR) is another term which applied some times in the literature to refer to PRR. It was suggested that PRR instead of PPR should not be used since prevalence proportions are not functions of time and so are not rates. (537, 538) This controversy still remains and mainly stems from lack of standard epidemiological terminology when there is not a common consensus on the definition and labelling of the indicators and therefore from application of a range of terms in the literature to refer to a same measure. PRR was decided to be used to indicate the difference in the prevalence of CVD risk factors between the comparison groups.

Prior to the advent of methods for the analysis of matched data sets it was common to ignore the matching criteria. (539) The rationale behind such a decision was that time was that matching might not change explicitly the estimate of outcome measure. But with the development of statistical methods it was shown that certain conditions should be met to be able to ignore matching in the analysis of matched sets (stratification variable should either be independent of disease status given the risk factors or independent of the risk factors given disease status). Even so, it was also indicated that both types of analyses may sometimes yield equivalent results if even these conditions are violated in practice. (539) Thus, the key point to consider in the analysis of matched data sets is that although there is a gain in power (narrower confidence interval) unmatched analysis may cause biased results. The direction of such a bias tends towards conservatism (increased likelihood of type II errors or false negative findings). In the matched analysis due to

slightly larger standard error the confidence interval estimated for the outcome measure will be wider compared to the unmatched analysis.

To see how analysis of the data based on the matching criteria will change the analysis result conditional logistic regression model (fitted via Cox regression model) was used to analyse a part of the study data which were collected about variables with dichotomous exposure based on one to many matched design (Dr Anderson N was consulted as statistician to choose the proper analysis method based on software availability and my training background).

Disputes in the literature about different alternatives to analyse cross-sectional data using PRR have not yet proposed a robust conclusion. (540, 541) Cox's proportional hazards model (Cox regression) was originally introduced for the estimation of the conditional hazard ratio in the complete or censored longitudinal data with varying follow-up time. (542) Breslow (543) indicated that by assuming constant risk period the conditional hazard ratio estimated by Cox model is equal to the PRR for cross sectional data. Barros and Hirakata (540) and other authors (538) have confirmed that application of Cox regression can produce directly a correct point estimate of PRR in the cross sectional studies but they also commented that the underlying distribution of the response using this model is Poisson while prevalence data in a cross sectional study follow a binomial distribution. Thus they concluded that the variance of the coefficients tends to be overestimated and so resulting in wider confidence intervals (less precision) compared to those based on the binomial distribution. Such a problem especially when the prevalence of the disease was high could be a major concern.

Some authors by considering available software rather than the estimator commented that using Cox model for binary outcomes is inappropriate because the model is created for survival data. (544) Complication of preparing data for analysis using Cox model (which is computationally simple) also have led some authors to conclude incorrectly that the method is invalid for calculation of PRR. (545)

The Robust Poisson method (applicable in SAS using PROC GENMOD syntax) (546) and log-binomial method are other introduced alternatives to analyse cross-sectional data using PRR. (541) However findings of this and another study (540) revealed that

point estimates obtained with Cox, Poisson and log-binomial models are very close to the Mantel-Haenszel prevalence ratio (MHPR) which has been introduced as an alternate indicator in the analysis of the matched data resulting from studies with one case to variable number of controls design. (539, 547) My own experience in calculating MHPR manually based on the methods explained by Breslow and Day (539) for matched data in the study design with one case to variable number of controls produced almost same point estimates with Cox regression method. As an interim approach, when using such a design in a future random based sample, application of a proper analysis strategy considering developments in the statistical methods to analyse matched data sets (with one case to variable many controls) should be contemplated whenever possible.

7.3 General characteristics of the three studied populations

Educational and occupational status of the three sample populations which were used to compare prevalence of CVD risk factors in this pilot study are indicated in Table 7.1.

Based on the findings a higher proportion of Iranian migrants in Edinburgh possess an academic qualification (having a BSc, MSc, MD or PhD) than the general White population and also Iranians in Tehran.

In relation to the occupational status a trivial difference (PRR=1.0, 95% CI: 0.9-1.2) was seen between the Iranian men and the Edinburgh's White men regarding the employment rate. Notwithstanding employment rate among the Iranian migrant women was about 15% lower than the Edinburgh's White women (PRR=0.8, 95% CI: 0.5-1.1). Lower employment rate among Iranian women in Edinburgh comparing to the Edinburgh's White women can be explained by a considerably higher rate of Iranian women (43.5% vs. 14.6%) reported to look after their family instead of working outside.

Having a managerial role in job (e.g. being a director, manager, supervisor or foreman, self employed with at least one employee in small or large establishments) among those who reported to be in paid employment was more prevalent among Iranian men than the Edinburgh's White men (PRR= 1.2, 95% CI: 0.8-1.6). In the female subgroup even a higher proportion of Iranians reported to have a managerial role in their jobs (PRR= 2.1, 95% CI: 1.2-3.9). None of Iranian migrants in Edinburgh reported to be unemployed.

Table 7.1 Educational and occupational status in the age and sex matched populations of Edinburgh White, Edinburgh Iranian and Iranian in Tehran.

Variables	Population: percent (95% CI)				Proportion ratio (95% CI)	
	Edinburgh White n= 257 (male=162, female= 95)	Edinburgh Iranian n= 72 (male= 49, female=23)	Iranian in Tehran n= 346 (male= 240, female= 112)		Edinburgh Iranian / Edinburgh White	Edinburgh Iranian / Iranian in Tehran
Academic qualifications *						
Male	25.9 (19.8, 33.2)	57.1 (43.3, 70.0)	14.4 (10.5, 19.5)		2.2 (1.5, 3.1) **	4.0 (2.7, 5.9) **
Female	22.1 (14.9, 31.4)	39.1 (22.2, 59.2)	10.0 (5.7, 17.0)		1.8 (0.9, 3.3)	3.9 (1.8, 8.3) **
Total	24.5 (19.7, 30.1)	51.4 (40.1, 62.6)	13.0 (9.9, 17.0)		2.1 (1.5, 2.9) **	4.0 (2.8, 5.6) **
In paid employment						
Male	82.7 (76.2, 87.8)	85.7 (73.3, 92.9)	NP †		1.0 (0.9, 1.2)	NA ††
Female	72.9 (63.3, 80.8)	56.5 (36.8, 74.4)			0.8 (0.5, 1.1)	
Total	79.1 (73.7, 83.6)	76.4 (65.4, 84.7)			1.0 (0.8, 1.1)	
Managerial role in job ‡ ±						
Male	46.3 (38.8, 54.0)	53.7 (38.8, 67.9)	NP		1.2 (0.8, 1.6)	NA
Female	25.3 (17.6, 34.8)	53.8 (29.1, 76.8)			2.1 (1.2, 3.9) **	
Total	38.5 (32.8, 44.6)	53.7 (40.6, 66.3)			1.4 (1.0, 1.9)	
Unable to work or retired						
Male	11.1 (7.1, 16.9)	12.2 (5.7, 24.2)	NP		1.1 (0.5, 2.6)	NA
Female	9 (9.4; 5.0, 16.9)	0			NA	
Total	10.5 (7.3, 14.8)	8.3 (3.9, 17.0)			0.8 (0.3, 1.9)	
Looking after family						
Male	1.9 (0.6, 5.3)	0	NP		NA	NA
Female	14.6 (8.9, 23.0)	43.5 (25.6, 63.2)			3.0 (1.5, 5.8) **	
Total	6.6 (4.2, 10.3)	13.9 (7.7, 23.7)			2.1 (1.0, 4.4)	
Student						
Male	1.9 (0.6, 5.3)	2.0 (3.6, 10.7)	NP		1.1 (0.1, 10.4)	NA
Female	1.0 (0.2, 5.7)	0			NA	
Total	1.6 (0.6, 3.9)	1.4 (0.3, 7.5)			0.9 (0.1, 7.9)	

Table continued on next page

Table 7.1 Educational and occupational status in the age and sex matched populations of Edinburgh White, Edinburgh Iranian and Iranian in Tehran (continued).

Variables	Population: percent (95% CI)				Proportion ratio (95% CI)	
	Edinburgh White	Edinburgh Iranian	Iranian in Tehran		Edinburgh Iranian	Edinburgh Iranian
	n= 257 (male=162, female= 95)	n= 72 (male= 49, female=23)	n= 346 (male= 240, female= 112)		/	/
Unemployed					Edinburgh White	Iranian exemplar
Male	2.5 (1.0, 6.2)	0	NP		NA	NA
Female	2.1 (0.6, 7.3)	0			NA	
Total	2.3 (1.1, 5.0)	0			NA	

* Having a BSc, MSc, MA or a higher academic degree.
† Not provided
‡ Having a managerial role in job e.g. being a director, manager, supervisor or foreman, self employed with at least one employee in small or large establishments.
± (Number of eligible persons: Edinburgh White: n= 204, M= 134, F= 70 and Edinburgh Iranian: n= 54, M= 41, F= 13)

7.4 Current or past history of cardiovascular disease

7.4.1 Applied definitions

The prevalence rates of major cardiovascular conditions among the study participants were calculated through asking direct questions about current or past history of having angina, heart attack, stroke or surgery due to a heart problem. For the purpose of this study, respondents were classified to have any one of the mentioned conditions only if they confirmed that the diagnosis was made by a doctor. In addition to direct questioning about angina and heart attack, Rose Angina Questionnaire (548) was also applied to estimate the prevalence of predicting symptoms of these conditions. Thus based on presence of pain on the sternum, the left arm or left anterior chest, informants were classified to have grade 1 angina if they reported to have this pain only when walking fast or uphill so that make them to stop or reduce speed. Those subjects who reported to have pain even when walking at an ordinary pace on the level was classified to have grade 2 angina. The respondents who reported to have a very severe pain across the front of their chest lasting for half an hour or more irrespective of medical diagnosis were classified to have possible myocardial infarction. Since needed data from the Iranian exemplar study were not provided, status of Edinburgh Iranian sample population in relation to the symptoms of angina or possible myocardial infarction was compared only with the age matched sample of Edinburgh white population.

7.4.2 Prevalence of current or past history of cardiovascular disease

As indicated in Table 7.2 some variations were observed between Edinburgh Iranians and Edinburgh White population regarding the prevalence of CVD. Due to the small number of cases who reported to have symptoms of angina grade 1 or 2, the subjects in these two groups were combined and classified in one groups as those who reported symptoms of angina grade 1 or 2. According to the findings, symptoms of angina grade 1 or 2 and possible myocardial infarction were more prevalent among Edinburgh's White men and women compared to the Iranian migrants. Although 95% confidence interval of the observed differences includes 1 (except in comparison of females who have reported symptom of possible myocardial infarction), such a result should be

Table 7.2 Symptoms of angina and possible myocardial infarction using the Rose Angina Questionnaire in the age and sex matched Edinburgh White and Edinburgh Iranian populations *: prevalence rate (PR %) and prevalence rate ratio (PRR).

Symptoms	Population: PR (95% CI)		PRR (95% CI)
	Edinburgh White n=258 (male= 162, Female= 96)	Edinburgh Iranian n=72 (male= 49, Female= 23)	
Chest pain ** in walking uphill or fast			
Male	6.2 (2.8, 13)	6.1 (1.6, 21.2)	1.0 (0.3, 3.5)
Female	5.2 (1.8, 14.5)	0	-
Total	5.8 (3.1, 10.8)	4.2 (1.1, 15)	0.7 (0.2, 2.4)
Chest pain in walking on the level			
Male	2.5 (0.7, 8)	8.2 (2.5, 23.9)	3.3 (0.9, 12.7)
Female	3.1 (0.8, 11.5)	4.3 (0.5, 28.7)	1.4 (0.2, 12.8)
Total	2.7 (1.1, 6.7)	6.9 (2.3, 18.8)	2.6 (0.8, 7.8)
Angina (Grade 1 or 2) †			
Male	3.1 (1.3, 7.0)	2.0 (0.2, 15.3)	0.7 (0.0, 5.9)
Female	2.1 (0.6, 7.3)	0	-
Total	2.7 (1.3, 5.5)	1.4 (0.2, 10.8)	0.5 (0.0, 4.0)
Possible myocardial infarction ‡			
Male	10.5 (5.8, 18.3)	2.0 (0.2, 15.3)	0.2 (0.0, 1.4)
Female	8.3 (3.5, 18.6)	4.3 (0.5, 28.7)	0.5 (0.1, 4.5)
Total	9.7 (5.9, 15.5)	2.8 (0.5, 13)	0.3 (0.1, 1.2)

* Data for Iranians in Tehran were not provided.
† Chest pain occurs when walking fast or uphill and make the subject either stop or reduce his/her speed or chest pain occurs even when walking at an ordinary pace on the level.
‡ Defined as a severe pain across the front of the chest lasting for half an hour or more.

interpreted with caution due to the small sample size in the pilot study. A higher proportion of Iranian male and female in Edinburgh have reported chest pain on their sternum, left arm or left anterior chest than the Edinburgh White matched cases. But since they did not mention that the pain made them to either stop or reduce their speed, they were not classified as having angina grade 1 or 2.

In Table 7.3 the prevalence of doctor-diagnosed CVD conditions is shown. Overall, Iranians in Edinburgh indicated a lower rate of CVD conditions than their matched Edinburgh White men and women. Only in the female subgroup more Iranians reported to have a history of heart attack or surgery due to a heart problem than Edinburgh's White women. Surgery due to a heart problem was about two times more prevalent among Iranian women than the Edinburgh's White women however; the effect of small sample size should be considered in interpreting the 95% confidence interval of the prevalence rate ratio which includes 1.

Ischaemic heart disease (IHD) defined as ever having a doctor diagnosed angina or a heart attack (549) also was less prevalent among Iranian migrants in Edinburgh compared to the Edinburgh White population. The difference especially in the male subgroup was considerable which needs to be investigated further in future large scale studies.

7.5 Physical inactivity

7.5.1 Applied definition

Physical activity levels were defined based on four main groups of activities which are home-based activities (e.g. housework, gardening, and building work including Do-It-Yourself (DIY) activities), walking, sports and exercise and finally activity at work. The recommended physical activity level which was applied in the Scottish Health Survey 2003 (550) used in this pilot study to classify people in two distinct groups: those who have at least a kind of moderate or vigorous physical activity on at least five days of the week and those who are inactive or have less physical activity than the recommended level. The cut-off point has been used in this pilot study to classify people as being inactive was 15 minutes or less for all discussed activities within recent four weeks.

Table 7.3 Doctor diagnosed major CVD conditions in the age and sex matched Edinburgh White and Edinburgh Iranian populations^{*}: prevalence rate (PR %) and prevalence rate ratio (PRR).

CVD conditions	Population: PR (95% CI)		PRR (95% CI)	
	Edinburgh White n=258 (male= 162, Female= 96)	Edinburgh Iranian n=72 (male= 49, Female= 23)	Edinburgh Iranian /	Edinburgh White
Angina				
Men	5.6 (3.0, 10.2)	2.0 (0.4, 10.7)		0.4 (0.0, 2.8)
Women	5.2 (2.2, 11.6)	4.3 (0.8, 21)		0.8 (0.1, 6.8)
Total	5.4 (3.3, 8.9)	2.8 (0.8, 9.6)		0.5 (0.1, 2.2)
Heart attack				
Men	3.1 (1.3, 7.0)	0		0
Women	4.2 (1.6, 10.2)	4.3 (0.8, 21)		1.0 (0.1, 8.9)
Total	3.5 (1.9, 6.5)	1.4 (0.3, 7.5)		0.4 (0.1, 3.1)
Stroke				
Men	1.0 (0.6: 0.1, 3.4)	0		0
Women	0	0		0
Total	1.0 (0.4: 0.1, 2.2)	0		0
Surgery due to a heart problem				
Men	4.0 (2.5: 1, 6.2)	0		0
Women	2.1 (0.6, 7.3)	4.4 (0.8, 21.0)		2.1 (0.2, 22.0)
Total	2.3 (1.1, 5)	1.4 (0.3, 7.5)		0.6 (0.1, 4.9)
Any of these CVD condition [‡]				
Men	6.8 (3.8, 11.8)	2.0 (0.4, 10.7)		0.3 (0.0, 2.3)
Women	7.3 (3.6, 14.3)	4.3 (0.8, 21.0)		0.6 (0.1, 4.6)
Total	7.0 (4.5, 10.8)	2.8 (0.8, 9.6)		0.4 (0.1, 1.7)
Ischaemic heart disease [‡]				
Men	6.2 (3.4, 11.0)	2.0 (0.4, 10.7)		0.3 (0.0, 2.5)
Women	7.3 (3.6, 14.3)	4.4 (0.8, 21.0)		0.6 (0.1, 4.6)
Total	6.6 (4.2, 10.3)	2.8 (0.8, 9.6)		0.4 (0.1, 1.8)

^{*} Data for Iranians in Tehran were not provided.

[‡] Reporting to have any of the above mentioned CVD conditions: angina, heart attack, stroke or surgery due to a heart problem.

[±] Defined as ever having a doctor diagnosed angina or a heart attack. (this definition was applied in the Scottish Health Survey 2003).

7.5.1 Prevalence of physical inactivity

As indicated in Table 7.4 while Iranian male respondents reported to have more sedentary life style but Iranian women in Edinburgh have indicated almost similar physically activity level with their age and sex matched controls. A higher proportion of Iranian women reported to do sport than Edinburgh White women and thus to have a better physical activity profile than their age matched controls. Among those who reported to be in employment about 44% of Iranian men and 93% of women told they are fairly or very physically active in their job. These rates were considerably higher than the rates were calculated for the Edinburgh White population.

7.6 Unhealthy dietary habits

7.6.1 Applied definitions

A modified and short version of the dietary questionnaire which was used in the Scottish Health Survey (550) and adopted from the Dietary Instrument of Nutrition Education (DINE) (551) was applied in this pilot study. Main focus of the questionnaire was to assess dietary habits of the respondents' and their usual intake of a balanced or imbalanced range of foods which may have role in the healthy maintenance of the body physiology or important negative side effects.

7.6.2 Prevalence of unhealthy dietary habits

The summarised data about the dietary habits of the study participants are shown in Table 7.5 and compared to the Scottish White representative population where possible. Some of the unhealthy dietary behaviours such as eating crisps, biscuits or chocolates once a day or more and also eating sweets, cakes, pastries or ice cream two or more times a week and use of full fat spread on bread, sandwiches or toast were less prevalent among Iranian migrants in Edinburgh. This is while other unhealthy behaviours such as drinking soft drinks once a day or more, eating red meat two or more times a week were reported in a higher rate compared to the Edinburgh's White population. According to the findings Iranian migrants had a higher consumption rate of red meat and poultry in their diet. Fish consumption (any kind) once a week or more was seen in a higher rate in the Edinburgh's Iranian women compared to the Edinburgh's White woman.

Table 7.4 Physical activity level in the age and sex matched Edinburgh White and Edinburgh Iranian populations *: prevalence rate (PR %) and prevalence rate ratio (PRR).

Activity	Population: PR (95% CI)		PRR (95% CI)
	Edinburgh White n= 258 (male=162, female= 96)	Edinburgh Iranian n= 72 (male=49, female= 23)	Edinburgh Iranian / Edinburgh White
Heavy manual/DIY **			
Males	35.2 (26.5, 45.3)	28.6 (15.3, 47.0)	0.8 (0.5, 1.3)
Females	14.6 (7.6, 26.2)	13.0 (3.4, 39.3)	0.9 (0.3, 2.9)
Total	27.5 (21.0, 35.2)	23.6 (13.3, 38.4)	0.9 (0.5, 1.4)
Brisk walk †			
Males	39.5 (30.2, 49.6)	20.4 (9.6, 38.3)	0.5 (0.3, 0.9) †
Females	27.1 (17.2, 40.0)	26.1 (10.0, 52.9)	1.0 (0.4, 2.1)
Total	34.9 (27.7, 42.8)	22.2 (12.3, 36.9)	0.6 (0.4, 1.0)
Sport ‡			
Males	52.5 (42.5, 62.3)	53.1 (35.4, 70.0)	1.0 (0.7, 1.4)
Females	51.0 (38.2, 63.7)	73.9 (47.1, 90.0)	1.4 (1.1, 2.0) †
Total	51.9 (44.0, 59.8)	59.7 (44.6, 73.2)	1.2 (0.9, 1.4)
Any of the above activities			
Males	78.4 (69.0, 85.5)	69.4 (51.0, 83.2)	0.9 (0.7, 1.1)
Females	67.7 (54.6, 78.5)	82.6 (55.9, 94.7)	1.2 (1.0, 1.5)
Total	74.4 (66.9, 80.8)	73.6 (58.6, 84.6)	1.0 (0.8, 1.2)
Fairly or very physically active job ^a			
Males	18.7 (13.0, 26.1)	44.2 (30.4, 58.9)	2.4 (1.5, 3.9) †
Females	21.7 (13.6, 32.8)	92.9 (68.5, 98.7)	4.3 (2.7, 6.8) †
Total	19.7 (14.8, 25.7)	56.1 (43.3, 68.2)	2.8 (2.0, 4.0) †
Moderate or vigorous activity level ^b			
Males	32.7 (26.0, 40.3)	8.2 (3.2, 19.2)	0.3 (0.1, 0.7) †
Females	22.9 (15.7, 32.3)	21.7 (9.7, 41.9)	0.9 (0.4, 2.2)
Total	29.1 (23.9, 34.9)	12.5 (6.7, 22.1)	0.4 (0.2, 0.8) †

Table continued on next page

Table 7.4 Physical activity level in the age and sex matched Edinburgh White and Edinburgh Iranian populations * :
prevalence rate (PR %) and prevalence rate ratio (PRR) (continued).

Activity	Population: PR (95% CI)		PRR (95% CI)
	Edinburgh White n= 258 (male=162, female= 96)	Edinburgh Iranian n= 72 (male=49, female= 23)	Edinburgh Iranian / Edinburgh White

* Data for Iranians in Tehran were not provided. ** Doing heavy manual work or DIY for at least 15 minutes in recent 4 weeks.

‡ Walking in a fairly brisk or fast pace for at least 15 minutes in recent 4 weeks. † Confidence interval does not include one.

± Doing above listed sports for at least 15 minutes in recent 4 weeks.

α Only among employed subjects: (in Edinburgh White population m= 134, f= 69 and in Edinburgh Iranians m=42, f=13)

β Doing at least one of the above activities for 15 minutes in recent four weeks.

Table 7.5 Dietary behaviours in the age and sex matched Edinburgh White and Edinburgh Iranian populations *: prevalence rate (PR %) and prevalence rate ratio (PRR).

Dietary behaviour	Population: PR (95% CI)		PRR (95% CI)
	Edinburgh White n= 258 (male=162, female= 96)	Edinburgh Iranian n= 72 (male=49, female= 23)	
Eating chocolates, crisps or biscuits once a day or more			
Males	46.9 (37.1, 57.0)	22.4 (10.9, 40.6)	0.5 (0.3, 0.8) **
Females	42.7 (30.6, 55.8)	26.1 (10.0, 52.9)	0.6 (0.3, 1.3)
Total	45.3 (37.6, 53.4)	23.6 (13.3, 38.4)	0.5 (0.3, 0.8) **
Eating sweets, cakes, pastries... two or more times a week			
Males	46.9 (37.1, 57.0)	28.6 (15.3, 47.0)	0.6 (0.4, 1.0)
Females	44.8 (32.5, 57.8)	30.4 (12.6, 57.1)	0.7 (0.4, 1.3)
Total	46.1 (38.3, 54.1)	29.2 (17.6, 44.3)	0.6 (0.4, 0.9) **
Drinking soft drinks once a day or more			
Males	19.1 (12.4, 28.3)	24.5 (12.4, 42.7)	1.3 (0.7, 2.3)
Females	14.6 (7.6, 26.2)	21.7 (7.5, 48.6)	1.5 (0.6, 3.7)
Total	17.4 (12.2, 24.3)	23.6 (13.3, 38.4)	1.4 (0.8, 2.2)
Eating red meat two or more times a week			
Males	69.8 (59.8, 78.1)	89.8 (73.5, 96.5)	1.3 (1.1, 1.5) **
Females	60.4 (47.3, 72.2)	69.6 (42.9, 87.4)	1.2 (0.8, 1.6)
Total	66.3 (58.4, 73.4)	83.3 (69.3, 91.7)	1.3 (1.1, 1.4) **
Eating poultry two or more times a week			
Males	69.1 (59.2, 77.6)	83.7 (66.2, 93.1)	1.2 (1.0, 1.4)
Females	61.5 (48.3, 73.1)	87.0 (60.7, 96.6)	1.4 (1.1, 1.8) **
Total	66.3 (58.4, 73.4)	84.7 (70.9, 92.7)	1.3 (1.1, 1.5) **
Eating any kind of fish once a week or more			
Males	55.6 (45.5, 65.2)	53.1 (35.4, 70.0)	1.0 (0.7, 1.3)
Females	47.9 (35.3, 60.8)	69.6 (42.9, 87.4)	1.5 (1.0, 2.0)
Total	52.7 (44.7, 60.6)	58.3 (43.3, 72.0)	1.1 (0.9, 1.4)

Table continued on next page

Table 7.5 Dietary behaviours in the age and sex matched Edinburgh White and Edinburgh Iranian populations *: prevalence rate (PR %) and prevalence rate ratio (PRR) (continued).

Dietary behaviour	Population: PR (95% CI)		PRR (95% CI)	
	Edinburgh White n= 258 (male=162, female= 96)	Edinburgh Iranian n= 72 (male=49, female= 23)	Edinburgh Iranian /	Edinburgh White
Drinking of skimmed or semi-skimmed milk				
Males	76.5 (69.4, 82.4)	36.7 (21.6, 55.1)		0.5 (0.3, 0.7) **
Females	74.0 (64.4, 81.7)	56.5 (31.5, 78.6)		0.8 (0.5, 1.1)
Total	75.6 (70.0, 80.4)	43.1 (29.2, 58.1)		0.6 (0.4, 0.8) **
Usually adding salt to food at the table				
Males	40.7 (31.3, 50.9)	22.4 (10.9, 40.5)		0.6 (0.3, 1.0)
Females	34.4 (23.3, 47.5)	17.4 (5.3, 44.1)		0.5 (0.2, 1.3)
Total	38.4 (31.0, 46.4)	20.8 (11.2, 35.4)		0.5 (0.3, 0.9) **
Usual use of full fat spread on bread, sandwiches, toast...				
Males	42.0 (32.5, 58.1)	4.1 (0.8, 18.4)		0.1 (0.0, 0.4) **
Females	45.8 (33.4, 58.8)	0		NA †
Total	43.4 (35.7, 51.4)	2.8 (0.5, 13.0)		0.1 (0.0, 0.3) **
Eating fruits and vegetable five times or more a day				
Males	21.6 (14.5, 31.0)	8.2 (2.5, 23.9)		0.4 (0.1, 1.0)
Females	31.3 (20.6, 44.3)	8.7 (1.7, 34.2)		0.3 (0.1, 1.1)
Total	25.2 (18.9, 32.7)	8.3 (3.1, 20.6)		0.3 (0.1, 0.7) **
Current alcohol drinking				
Male	90.7 (83.2, 95.1)	75.5 (57.3, 87.6)		0.8 (0.7, 1.0)
Female	87.5 (76.3, 93.8)	52.2 (28.0, 75.4)		0.6 (0.4, 0.9) **
Total	89.5 (83.6, 93.5)	68.1 (52.9, 80.2)		0.8 (0.6, 0.9) **

* Data for Iranians in Tehran were not provided.

** Confidence interval does not include 1.

† Not applicable.

but the rate was similar in the male subgroups. A lesser consumption rate of skimmed or semi skimmed milk or sufficient portions of fruits and vegetables (five times or more a day) in the daily diet was evident among the Iranian migrants compared to the Edinburgh White population.

Usual adding of salt to food at the table was more prevalent among Edinburgh's White men and women than the Iranian migrants.

Questions about drinking of alcoholic beverages in this pilot study were mainly included to clarify alcohol drinking behaviour of the respondents and also to see how informants answer questions related to their alcohol drinking habits or their willingness to answer the questions at all. This concern was raised due to the illegality of drinking alcoholic beverages in public places in any quantity in Iran according to the current laws and that Muslims are forbidden from drinking alcoholic drinks according to the Islamic rules. The study results (shown in Table 7.5) indicated that at least 75.5% of the Iranian men and about half of women had no reservation to answer question(s) about their alcohol drinking behaviour.

7.7 Smoking

7.7.1 Applied definition

Self reported smoking was used to determine smoking behaviour of the respondents. People who reported to smoke currently at least one cigarette a day was classified as being smoker.

7.7.2 Prevalence of self-reported smoking

Self reported daily smoking rate among Iranian men and women settled in Edinburgh was high compared to Iranians in Tehran and the difference especially in the female subgroup was noteworthy (Table 7.6). Smoking rate also among Iranian migrant men was higher than the rate observed for the Edinburgh's White men. But notably the calculated rate for Iranian migrant women was about 40% of the rate calculated for Edinburgh's White women.

Table 7.6 Self reported smoking in the age and sex matched populations of Edinburgh White, Edinburgh Iranian and Iranians in Tehran: prevalence rate (PR %) and prevalence rate ratio (PRR).

Variable	Population: PR (95% CI)			PRR (95% CI)		
	Edinburgh White n= 255 (male=160, female= 95)	Edinburgh Iranian n= 72 (male=49, female= 23)	Iranian in Tehran n= 344 (male=233, female= 111)	Edinburgh Iranian / Edinburgh White	Edinburgh Iranian / Iranian in Tehran	
Self reported smoking*						
Males	21.9 (14.7, 31.3)	30.6 (16.8, 49.0)	22.7 (17.8, 28.6)	1.4 (0.8, 2.3)	1.3 (0.8, 2.2)	
Females	34.7 (23.5, 48.0)	13.0 (3.4, 39.3)	0.9 (0.2, 4.9)	0.4 (0.1, 1.1)	14.5 (1.6, 133.1) **	
Total	26.7 (20.2, 34.3)	25.0 (14.3, 39.9)	15.7 (12.2, 19.9)	0.9 (0.6, 1.5)	1.6 (1.0, 2.5)	

* Current smoking of at least one cigarette a day.

** Confidence interval does not include one.

7.8 Hypertension

7.8.1 Applied definitions, instruments and procedures

As a limitation to the comparison of mean blood pressure levels between the comparison groups it is important to note that a digital sphygmomanometer for blood pressure measurement was used in this pilot study (Omron 705IT) and also Scottish Health Survey 2003 (Omron HEM 907) but in the Iranian study mercury sphygmomanometers (it's model and brand not provided) were applied. The systolic (SBP) and diastolic (DBP) blood pressure measures provided from the Iranian study all were rounded up to the nearest whole number. The average differences between the Omron 705IT device and mercury sphygmomanometer readings for SBP and DBP were reported to be -0.2 mmHg (standard deviation = 4.5) and -2.0 mmHg (standard deviation = 4.8) respectively which fulfils the recommended criteria of the international protocol of the European Society of Hypertension. (552) If there was technically an available method to convert measures in the three separate studies into a standard set of measurements according to the results of previously performed calibration studies, the comparison of SBP and DBP measures in the three populations would be more reliable. But in the lack of needed regression equations, variations in the measurement methods were ignored and mean values of both systolic and diastolic blood pressure in the three populations were applied for interpretation.

7.8.2 Prevalence of hypertension

Mean levels of systolic (SBP) and diastolic (DBP) blood pressure for all three comparison groups are indicated in Table 7.7. The findings revealed that Iranian men and women in Tehran had a lower mean level of systolic and diastolic blood pressure than the Iranians in Edinburgh. The difference in the mean systolic blood pressure of Iranians in Edinburgh compared to the Edinburgh White population was trivial but Iranian men had a higher level of diastolic blood pressure compared to their age matched White men.

In Table 7.8 the prevalence of hypertension based on the measured or reported systolic and diastolic blood pressure in the comparison groups are shown. Also findings

Table 7.7 Mean systolic (SBP) and diastolic (DBP) blood pressure levels in the age and sex matched populations of Edinburgh White, Edinburgh Iranian and Iranians in Tehran.

Variables	Population: mean (95% CI)			Mean difference (95% CI)	
	Edinburgh White n= 150 (Male= 93, Female= 57)	Edinburgh Iranian n=72 (Male= 49, Female= 23)	Iranian in Tehran n=344 (Male= 233, Female= 111)	Edinburgh White minus Edinburgh Iranian	Iranian in Tehran minus Edinburgh Iranian
SBP					
Male	130.6 (127.7, 133.5)	130.6 (126.8, 134.3)	117.7 (115.5, 119.9)	0.1 (-6.5, 6.6)	-12.9 (-18.7, -7.0) *
Female	121.6 (116.6, 126.7)	120.3 (114.1, 126.6)	111.7 (108.8, 114.6)	1.3 (-8.3, 10.9)	-8.6 (-17.5, 0.2)
Total	127.2 (124.5, 129.9)	127.3 (123.9, 130.6)	115.8 (114.0, 117.5)	-0.1 (-5.6, 5.4)	-11.5 (-16.5, -6.6) *
DBP					
Male	77.4 (75.2, 79.7)	81.4 (79.0, 83.8)	77.3 (76.0, 78.5)	-4.0 (-7.5, -0.5) *	0.95 (0.9, 0.99) †‡
Female	76.0 (73.1, 78.9)	75.6 (71.2, 80.0)	71.9 (70.2, 73.6)	0.4 (-5.4, 6.1)	-3.7 (-9.0, 1.6)
Total	76.9 (75.1, 78.6)	79.6 (77.4, 81.8)	75.5 (74.5, 76.6)	-2.7 (-5.6, 0.2)	0.95 (0.9, 1.0) †

* Confidence interval does not include zero.

† Exponential geometric mean difference (which is actually ratio of the two calculated geometric means).

‡ Confidence interval of exponential geometric mean difference (which is actually ratio of the two calculated geometric means) does not include 1.

Table 7.8 Prevalence of hypertension in the age and sex matched populations of Edinburgh White, Edinburgh Iranian and Iranians in Tehran: prevalence rate (PR%) and prevalence rate ratio (PRR).

Variables	Population: PR (95% CI)				PRR (95% CI)	
	Edinburgh White n= 257 (Male= 162, Female= 95)	Edinburgh Iranian n=72 (Male= 49, Female= 23)	Iranian in Tehran n=360 (Male= 245, Female= 115)		Edinburgh Iranian / Edinburgh White	Edinburgh Iranian / Iranian in Tehran
Hypertension ^α						
Male	21.5 (14.4, 30.1) *	22.4 (13.0, 35.9)	13.7 (9.9, 18.8) †	1.0 (0.5, 2.0)	1.6 (0.9, 3.0)	
Female	17.5 (9.8, 29.4) **	13.0 (4.5, 32.1)	5.4 (2.5, 11.3) ‡‡	0.7 (0.2, 2.5)	2.4 (0.7, 9.0) ^β	
Total	20.0 (14.4, 27.1)	19.4 (12.0, 30.0)	11.1 (8.2, 14.8)	1.0 (0.6, 1.7)	1.8 (1.0, 3.1)	
Current or past history of hypertension ^ε						
Male	22.2 (15, 31.7)	20.4 (9.6, 38.3)	NP [†]	1.1 (0.5, 2.6)	NA ^{††}	
Female	21.1 (12.4, 33.6)	0	NP	0		
Total	21.8 (15.9, 29.1)	13.9 (6.4, 27.5)	NP	0.7 (0.3, 1.4)		
Being under treatment for hypertension ^ε						
Male	10.6 (5.8, 18.6) [±]	10.2 (3.5, 26.5)	NP	1.0 (0.3, 3.6)	NA	
Female	3.3 (0.8, 12.3) ^{±±}	0	NP	0		
Total	8 (4.6, 13.6)	6.9 (2.3, 18.8)	NP	0.9 (0.3, 2.8)		
^α SBP≥ 140 mmHg or DBP ≥ 90 mmHg.						
^β Confidence interval does not include 1.						
^{±±} n= 90						
[*] n= 93						
€ Self reported.						
^{**} n= 57						
[†] Not provided.						
[‡] n= 233						
^{††} Not applicable.						
^{‡‡} n= 111						
[±] n=160						

regarding the self reported current or past history of hypertension or being under treatment for hypertension are provided in this table. According to the results, Iranian men and women in Edinburgh indicated a higher prevalence of hypertension compared to the Iranian men in Tehran. The prevalence rate of hypertension among Iranian women in Edinburgh was lower than the Edinburgh White women. Rate of current or past history of hypertension was reported to be almost same in the Edinburgh Iranian and White men. But none of the Iranian women in Edinburgh was reported a current or past history of hypertension while about 13% of them were hypertensive based on their measured systolic and diastolic blood pressure level. About 50% of Iranian and White men in Edinburgh who reported to have a current or past history of hypertension but only about 15.6% of White women reported to be under treatment for hypertension.

7.9 Overweight and obesity

7.9.1 Applied definition

Body mass index (BMI) which is defined as the weight in kilograms divided by the square of the height in metres (kg/m^2) was used to determine the prevalence of overweight and obesity in the comparison groups. A BMI $\geq 25 \text{ kg/m}^2$ but $< 30 \text{ kg/m}^2$ was considered as the marker of overweight and a BMI $\geq 30 \text{ kg/m}^2$ as the marker of obesity.

7.9.2 Prevalence of overweight and obesity

Findings of this study indicated no major difference in the body mass index of all three comparison groups (Table 7.9). Iranian women in Edinburgh however, indicated a slightly lower BMI and also mean weight compared to their age matched counterparts in Iran and also Edinburgh White women. Such a difference was not concurrent with regard to their height since they had a higher mean height level compared to the Iranian women in Tehran. Iranian women in Edinburgh also had a lower waist to hip ratio than their counterparts in Iran. The difference in the waist circumference was especially remarkable between Iranian women in Edinburgh and Tehran. Thus it seems that Iranian migrant women in Edinburgh have a better anthropometric profile compared to the women in Iran. Iranian men in Edinburgh in average were about 3 centimetres taller than

Table 7. 9 Body Mass Index (BMI) and waist to hip ratio (WHR) in the age and sex matched populations of Edinburgh White, Edinburgh Iranian and Iranians in Tehran: mean and mean difference.

Variables	Population: mean (95% CI)			Mean difference (95% CI)	
	Edinburgh White n= 224 (Male=135, Female=89)	Edinburgh Iranian n=72 (Male= 49, Female= 23)	Iranian in Tehran n=344 (Male= 234, Female= 110)	Edinburgh White minus Edinburgh Iranian	Iranian in Tehran minus Edinburgh Iranian
	(Male= 128, Female= 85) 28.3 (27.6, 29.1) 27.3 (26.2, 28.5) 27.9 (27.3, 28.6)	(Male= 49, Female= 23) 27.6 (26.6, 28.5) 26.3 (24.5, 28.1) 27.2 (26.0, 28.0)	(Male= 234, Female= 110) 27.0 (26.5, 27.6) 28.8 (27.8, 29.8) 27.6 (27.1, 28.1)		
BMI					
Male				0.8 (-0.8, 2.4)	-0.5 (-2.0, 1.0)
Female				1.1 (-1.8, 3.9)	2.5 (-0.4, 5.3)
Total				0.8 (-0.7, 2.3)	0.5 (-0.9, 1.8)
Weight	(Male= 129, Female= 85) 86.4 (83.8, 89.1) 71.5 (68.2, 74.7) 80.9 (78.7, 83.1)	82.7 (79.3, 86.1) 66.5 (62.1, 71.0) 77.5 (74.3, 80.7)	78.7 (77.0, 80.5) 70.7 (68.3, 73.1) 76.2 (74.7, 77.6)	3.8 (-1.7, 9.2) 5.0 (-1.6, 11.6) 3.4 (-0.7, 7.5)	-3.9 (-9.1, 1.2) 4.2 (-1.4, 9.8) -1.3 (-4.8, 2.1)
Height					
Male	175.4 (174.2, 176.7)	173.6 (171.9, 175.4)	170.6 (169.7, 171.5)	1.8 (-0.9, 4.5)	-3.0 (-5.6, -0.5) *
Female	161.8 (160.5, 163.2)	159.2 (156.9, 161.6)	156.9 (155.8, 157.9)	2.6 (-0.7, 5.8)	-2.4 (-5.6, 0.8)
Total	170.0 (168.7, 171.3)	169.0 (166.9, 171.2)	166.2 (165.3, 167.2)	1.0 (-2.0, 3.9)	-2.8 (-5.7, -0.0)
WHR	(Male= 115, Female= 67) 0.93 (0.91, 0.94) 0.81 (0.80, 0.83) 0.89 (0.87, 0.90)	0.95 (0.93, 0.96) 0.83 (0.81, 0.86) 0.91 (0.89, 0.93)	0.97 (0.96, 0.97) 0.85 (0.84, 0.86) 0.93 (0.92, 0.94)	-0.0 (-0.0, 0.0) -0.0 (-0.1, 0.0) -0.0 (-0.1, 0.0)	0.0 (-0.0, 0.0) 0.0 (-0.0, 0.1) 0.0 (-0.0, 0.1)
Waist circumference	(M=115, Female= 67) 97.6 (95.5, 99.7) 84.5 (81.4, 87.5) 92.8 (90.8, 94.7)	95.2 (92.1, 98.2) 81.5 (77.4, 85.7) 90.8 (88.0, 93.6)	96.4 (95.1, 97.8) 89.0 (86.7, 91.3) 94.1 (92.9, 95.3)	2.4 (-1.8, 6.7) 2.9 (-2.7, 8.6) 2.0 (-2.0, 5.9)	1.3 (-2.6, 5.2) 7.5 (2.2, 12.7) * 3.3 (-0.4, 6.9)
Hip circumference	(M=115, Female= 67) 105.2 (103.8, 106.5) 103.4 (100.9, 105.8) 104.5 (103.3, 105.8)	99.7 (97.4, 102.0) 97.3 (92.7, 101.9) 98.95 (96.9, 101.1)	99.5 (98.7, 100.4) 104.4 (102.6, 106.2) 101.1 (100.2, 102.0)	5.4 (2.6, 8.3) * 6.1 (0.5, 1.7) * 5.6 (2.8, 8.3) *	-0.2 (-2.8, 2.4) 7.1 (1.8, 12.5) * 2.1 (-0.4, 4.7)

* 95% confidence interval of mean difference does not include zero.

the men in Tehran but since they also had a higher mean weight compared to their matched controls in Iran the calculated BMI did not indicate any major difference between these two groups. Iranian men and women in Edinburgh had slightly higher waist to hip ratio compared to Scottish control group but the difference seems not to be significant.

The prevalence of overweight among Iranian men and women in Edinburgh was higher than both Scottish White and Iranian indigenous population (Table 7.10). Also prevalence of the obesity among Iranian men in Edinburgh was higher than their counterparts in Iran but lower than the Edinburgh White men. Most notably the prevalence of obesity among Iranian women resident in Edinburgh was lower compared to their age matched controls in Tehran and Edinburgh. None of these differences were statistically significant but effect of small sample size in the test results should not be disregarded and these differences warrant to be investigated in a future large scale study.

7.10 Hyperlipidaemia

7.10.1 Applied definitions and procedures

It was not possible to compare the applied laboratory and analysis technique of blood lipids in the three studies since they were conducted in different time frames and more importantly full details of measurement protocols of blood lipids were not given in the studies. According to the provided information, HDLc analysis was carried out in the Scottish Health Survey 2003 by the direct method (no precipitation) (550) while in the Tehran Lipid and Glucose Study the measurement was carried out after precipitation of apo-B lipoprotein. (553) It was suggested that use of direct method may bias the result with overestimation of low HDLc concentration (554, 555) however use of the direct method is more convenient and possibility of errors such as misidentification or loss of the sample (during centrifugation) is much lower than the conventional method. So considering all these limitations, it was not possible to adjust available data for possible variations in the laboratory methods. Thus the data were applied for blood lipids comparison by ignoring possible bias divergent applied laboratory techniques in three studies may pose on the findings.

Table 7.10 Overweight and obesity in the age and sex matched populations of Edinburgh White, Edinburgh Iranian and Iranians in Tehran: prevalence rate (PR %) and prevalence rate ratio (PRR).

Variable	Population: PR (95% CI)			PRR (95% CI)	
	Edinburgh White n= 213 (Male= 128, Female= 85)	Edinburgh Iranian n=72 (Male= 49, Female= 23)	Iranian in Tehran n=344 (Male= 234, Female= 110)	Edinburgh Iranian / Edinburgh White	Edinburgh Iranian / Iranian in Tehran
Overweight*					
Male	46.1 (37.7-54.7)	51.0 (37.5-64.4)	49.6 (43.2-55.9)	1.1 (0.8-1.5)	1.0 (0.8-1.4)
Female	44.7 (34.6-55.3)	47.8 (29.2-67.0)	45.5 (36.5-54.8)	1.1 (0.7-1.7)	1.1 (0.7-1.7)
Total	45.5 (39.0-52.3)	50.0 (38.8-61.3)	48.3 (43.0-53.5)	1.1 (0.8-1.4)	1.0 (0.8-1.3)
Obesity**					
Male	32.8 (25.3-41.3)	28.6 (17.9-42.4)	19.7 (15.1-25.2)	0.9 (0.5-1.4)	1.5 (0.9-2.4)
Female	20.0 (12.9-29.7)	13.0 (4.5-32.1)	34.6 (26.3-43.8)	0.7 (0.2-2.0)	0.4 (0.1-1.1)
Total	27.7 (22.1-34.1)	23.6 (15.3-34.6)	24.4 (20.2-29.2)	0.9 (0.5-1.4)	1.0 (0.6-1.5)

* 25 ≤ Body Mass Index (BMI) < 30

** Body Mass Index (BMI) ≥ 30

Table 7.11 Total cholesterol (TC), high (HDL-C) and low (LDL-C) density lipoprotein cholesterol and triglycerides levels in the age and sex matched populations of Edinburgh White, Edinburgh Iranian and Iranians in Tehran: mean and mean difference.

Variables	Population: mean (mmol/l) (95% CI)			Mean differences (mmol/l) (95% CI)	
	Edinburgh White n=150 (Male=94, Female=56)	Edinburgh Iranian n=72 (Male=49, Female=23)	Iranian in Tehran n=349 (Male=237, Female=112)	Edinburgh White minus Edinburgh Iranian	Iranian in Tehran minus Edinburgh Iranian
TC					
Male	5.9 (5.7, 6.2)	5.0 (4.7, 5.2)	5.0 (4.8, 5.1)	1.0 (0.6, 1.4) *	0.01 (-0.4, 0.4)
Female	5.7 (5.4, 6.0)	4.9 (4.7, 5.2)	5.1 (4.9, 5.3)	0.7 (0.1, 1.3) *	0.1 (-0.4, 0.7)
Total	5.8 (5.7, 6.0)	5.0 (4.8, 5.2)	5.0 (4.9, 5.1)	0.9 (0.5, 1.2) *	0.04 (-0.3, 0.4)
HDL-C					
Male	1.4 (1.3, 1.5)	1.2 (1.1, 1.3)	0.94 (0.92, 0.98)	0.2 (0.1, 0.3) *	0.8 (0.7, 0.99) †‡
Female	1.6 (1.5, 1.7)	1.45 (1.3, 1.6)	1.07 (1.03, 1.12)	0.2 (0.0, 0.3)	-0.4 (-0.5, -0.2) *
Total	1.5 (1.4, 1.5)	1.26 (1.2, 1.3)	0.99 (0.96, 1.00)	1.2 (1.0, 1.4)	0.8 (0.6, 0.96) †‡
TC/HDL-C ratio					
Male	4.4 (4.2, 4.6)	4.5 (4.1, 4.9)	5.4 (5.3, 5.6)	-0.1 (-0.7, 0.5)	1.0 (0.5, 1.5) *
Female	3.6 (3.4, 3.8)	3.6 (3.2, 4.0)	5.0 (4.7, 5.3)	-0.01 (-0.8, 0.8)	1.4 (0.6, 2.1) *
Total	4.1 (3.9, 4.3)	4.2 (3.9, 4.5)	5.3 (5.1, 5.5)	-0.1 (-0.6, 0.4)	1.1 (0.7, 1.5) *
LDL-C					
Male	NA [‡]	3.1 (2.8, 3.3) ††	3.1 (2.9, 3.17) €	NA	-0.0 (-0.3, 0.2)
Female		3.0 (2.8, 3.3)	3.2 (3.0, 3.4)		0.2 (-0.2, 0.6)
Total		3.1 (2.9, 3.3)	3.1 (3.00, 3.2)		0.1 (-0.2, -0.3)
TGs					
Male	NA	1.5 (1.3, 1.8)	2.1 (1.9, 2.3)	NA	1.3 (1.1, 1.5) †‡
Female		1.0 (0.8, 1.2)	1.7 (1.5, 2.0)		1.6 (1.4, 1.9) †‡
Total		1.4 (1.2, 1.5)	2.0 (1.8, 2.1)		1.4 (1.2, 1.6) †‡

* Confidence interval does not include zero.

† Exponential geometric mean difference and exponential confidence interval.

‡ Confidence interval of geometric mean difference (which is actually ratio of the two calculated geometric means) does not include 1.

± Not applicable.

€ n= 307, male= 204, female=103

7.10.2 Prevalence of hyperlipidaemia

Total and high density lipoprotein level (TC, HDLc), level of low density lipoprotein (LDLc), triglycerides along with TC/HDLc ratio for informants in three populations are indicated in Table 7.11. Iranian migrants have shown a lower level of total cholesterol and HDLc compared to the Edinburgh White population however, there was not a major difference in TC/HDLc ratio between two populations. This is while Iranian men and women in Edinburgh indicated a better HDL-C profile than the Iranian in Tehran which also led to an improved TC/HDL-C ratio in this group. Mean triglycerides level also was lower among both Iranian men and women in Edinburgh compared to their counterparts in Iran. It was not possible to compare Iranian status in Edinburgh with the Edinburgh White population regarding the triglycerides level since it was not measured in the Scottish Health Survey 2003. The overall impression is that Iranians in Edinburgh have an improved lipid profile than their age matched controls in Iran but their HDL-C level was slightly lower than the level in the Edinburgh White population.

7.11 Diabetes

7.11.1 Applied definition

Respondents are classified to have diabetes in this study only if they stated that diabetes was diagnosed by a doctor. Since fasting blood sugar was not measured in the Scottish Health Survey 2003 and the data for Tehran Lipid and Glucose Study were not provided it was not possible to compare fasting blood sugar levels in three comparison groups. Thus distinct judgment about the prevalence of diabetes among Iranians in Edinburgh and Scottish White population was only made based on respondents' reports from their previously diagnosed diabetes.

7.11.2 Prevalence of diabetes

Mean fasting glucose level was 5.0 mmol/l (95% CI: 4.4, 5.6) for men and 4.1 (95% CI: 2.9, 5.4) for women among Edinburgh Iranian population. According to the World Health Organisation's criteria (515) about 2.1% of men (95% CI: 0.4, 10.9) and none of the Iranian women in Edinburgh had diabetes (Plasma fasting blood sugar ≥ 7 mmol/l). Presence of impaired fasting glycaemia (IFG: 6.1 mmol/l \leq FBS < 7 mmol/l) (515) was

Table 7.12 Doctor diagnosed diabetes in the age and sex matched Edinburgh White and Iranian migrant population: prevalence rate and prevalence rate ratio (PRR).

Variable	Population: PR (95% CI)		PRR (95% CI)
	Edinburgh White n= 257 (Male= 162, Female= 96)	Edinburgh Iranian n=72 (Male= 49, Female= 23)	Edinburgh Iranian / Edinburgh White
Diabetes *			
Male	4.3 (2.1, 8.7)	4.1 (1.1, 13.7)	0.9 (0.1, 5.0)
Female	1.0 (0.2, 5.7)	0	0
Total	3.1 (1.6, 6.0)	2.8 (0.8, 9.6)	0.9 (0.1, 4.5)

* Presence of a doctor diagnosed

also evident among 6.3% of men (95% CI: 2.2, 16.8) and about 4.5% of women (95% CI: 0.8, 21.8) based on the blood samples analysis.

Prevalence of the self reported diabetes among Iranian migrants and Edinburgh’s White population is indicated in Table 7.12. The findings may imply that Iranian migrants in Edinburgh are not in added risk of diabetes compared to the Scottish White population but obviously a robust judgement will only be possible when a randomly selected population of Iranian migrants will be investigated.

7.12 Comparison of analysis result based on unmatched and matched design

To assess effect of analysis method on the results of data collected based on a matched design, the analysis result compared when data were pooled and matching criteria was ignored with the results of data analysis based on matched design (one control to many variable controls). The findings are provided in Table 7.13 and as seen in most cases the point estimates are exactly same but there are very trivial differences in their confidence intervals. These findings indicate that matched analysis of data collected in a matched design using conditional logistic regression model (fitted via Cox

Table 7.13 Prevalence rate ratio (PRR) of the CVD conditions or risk factors with dichotomous exposure in the age and sex matched populations of Edinburgh White, Edinburgh Iranian and Iranians in Tehran: application of conventional and matching techniques in the data analysis.

Variables	PRR (95% CI): conventional technique		PRR (95% CI): matching technique	
	Edinburgh Iranian / Edinburgh White	Edinburgh Iranian / Iranian in Tehran	Edinburgh Iranian / Edinburgh White	Edinburgh Iranian / Iranian in Tehran
Possible myocardial infarction [†]				
Male	0.2 (0.0, 1.4)	NA [‡]	0.2 (0.0, 1.4)	NA
Female	0.5 (0.1, 4.5)		0.5 (0.1, 4.5)	
Total	0.3 (0.1, 1.2)		0.2 (0.0, 1.3)	
Doctor diagnosed Angina				
Male	0.4 (0.0, 2.8)	NA	0.4 (0.1, 2.8)	NA
Female	0.8 (0.1, 6.8)		0.8 (0.1, 8.8)	
Total	0.5 (0.1, 2.2)		0.3 (0.0, 2.3)	
Doctor diagnosed CVD condition [†]				
Male	0.3 (0.0, 2.3)	NA	0.3 (0.0, 2.3)	NA
Female	0.6 (0.1, 4.6)		0.6 (0.1, 5.4)	
Total	0.4 (0.1, 1.7)		0.2 (0.0, 1.8)	
Self reported current smoking [*]				
Male	1.4 (0.8, 2.3)	1.3 (0.8, 2.2)	1.2 (0.5, 2.7)	1.5 (0.8, 3.0)
Female	0.4 (0.1, 1.1)	14.5 (1.6, 133.1) ^{**}	0.3 (0.1, 1.1)	NC [€]
Total	0.9 (0.6, 1.5)	1.6 (1.0, 2.5)	0.7 (0.4, 1.4)	1.9 (1.0, 3.7)

[†] Defined as a severe pain across the front of the chest lasting for half an hour or more. [‡] Not applicable
[‡] Having at least one of the follow conditions: angina, heart attack, stroke, surgery due to a heart problem.
^{*} At least one cigarette a day.
^{**} Confidence interval does not include 1 but it is very wide due to inadequacy of data (very small number of smokers in the case and control groups).
[€] The data in the comparison groups did not fit the Cox's regression model for one case to variable many matched controls due to inadequate data in case and control groups (number of smokers in case group = 3 and in control group = 1).

regression model) versus unmatched analysis will direct findings towards more conservatism with providing a slightly wider confidence intervals.

7.13 Summary of results

Findings of this study regrading the prevalence of CVD risk factors in three comparison groups are shown in Figure 7.1. Only those risk factors were indicated in the figure that there were available data for all three groups in order to give an overview about the observed differences. Smoking with overweight and obesity are the most prevalent CVD risk factors among Iranian migrants that need to be focused in future research on this ethnic group.

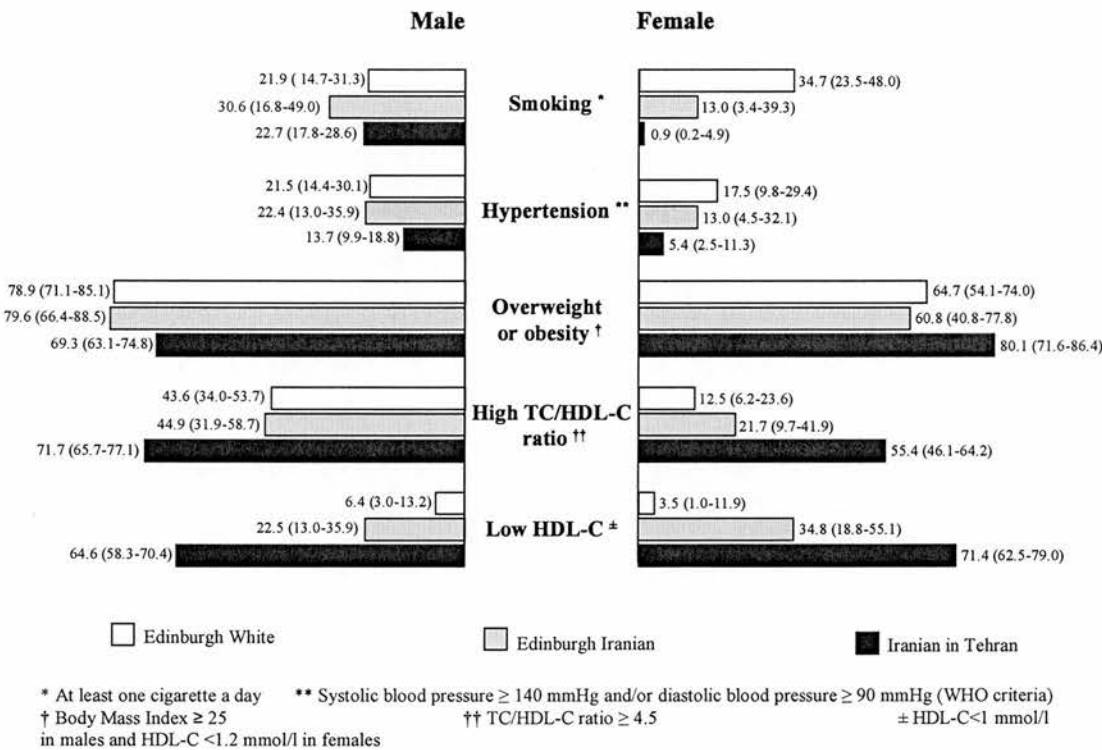


Figure 7.1 Prevalence rate (95% CI) of a selected number of CVD risk factors in the age matched populations of Edinburgh White, Edinburgh Iranian and Iranians in Tehran.

A high level of hypertension among Iranian migrant men and women in Edinburgh compared to their counterparts also warrant to be investigated further. Iranian migrants

in Edinburgh while had an apparent improved lipid profile compared to their age matched controls in Tehran but still a high level of TC/HDL-C ratio especially among Iranian migrant women needs to be addressed.

7.14 Discussion

Based on the findings a higher proportion of Iranian migrants in Edinburgh possess an academic qualification than the general White population and also Iranian in Tehran. Notwithstanding employment rate among the Iranian migrant women was about 15% lower than the Edinburgh's White women. Based on the study findings it was also evident that a higher proportion of Iranian men in Edinburgh have a managerial role in their job than the Edinburgh's White men. In the female subgroup proportion of people who reported to have a managerial role was even higher compared to their age matched controls in Edinburgh.

In the interpretation of this findings possibility of bias in the recruitment phase of the study sample should not be disregarded. For instance it is probable that mostly educated people made themselves available to participate in this pilot study due to a better knowledge about consequences of cardiovascular diseases. While every effort was made to prevent selection bias in the recruitment stage but as a limitation of non-random sampling method, possibility of such a bias should not be ruled out completely. Effect of small sample size especially in the female subgroup also should not be disregarded in the interpretation of the results.

The observed difference in the level of education is concordant with the result of previous studies (298, 299, 304, 306, 307) in relation to the better educational profile of Iranian migrants who left the country due to the special circumstances like war and economic constraints in the home country. Lower employment rate among Iranian women in Edinburgh comparing to the Edinburgh's White women can be explained by a considerably higher rate of Iranian women (43.5% vs. 14.6%) reported to look after their family instead of working outside.

In addition to possibility of sample selection bias which was inevitable due to the explained limitations in accessing Iranians in Edinburgh this results also can reflect in part selective placement of Iranian educated and wealthy migrants in Edinburgh (such as

the pattern exist in Beverly Hills in the western part of the Los Angeles County in California, United States) since this city is one of the relatively expensive cities to live compared to other neighbouring cities in Scotland or other major cities in the UK. Another hypothesis could be participation of mostly wealthy Iranians in this pilot study due to the importance and priority of health in their value system. Based on this assumption less wealthy or deprived Iranian refrained from participation in the study due to the low self perceived threat of the disease or simply because they have not received the invitation messages for participation. Thus under-representation of those with limited social contacts, low education level and knowledge about CVD in this pilot study is possible.

In relation to the prevalence of CVD conditions and symptoms while a higher proportion of Iranian men and women in Edinburgh reported to have a chest pain compared to Edinburgh White controls but since their pain did not make them to either stop or reduce their speed, they were not classified as having angina grade 1 or 2. In the lack of other diagnostic evidences it is very difficult to have a robust judgement about the observed difference however; variable level of perceived threat and sensitivity to the disease and also awareness about the symptoms of myocardial infarction and also subjective variations in the stated severity of chest pain probably had more important role in the observed differences. Healthy migrant effect and sample selection bias should also not be disregarded as the possible contributing factors for the observed higher prevalence of the other doctor diagnosed CVD conditions among Edinburgh's White men and women compared to the Iranian migrants in Edinburgh.

The study findings revealed that a noticeably lower proportion of Iranian men in Edinburgh had adequate physical activity level compared to Edinburgh White men. But moderate or vigorous physical activity level was seen among Iranian women in an almost similar rate with the Edinburgh White controls. Such a result was not supported by the results of previously conducted studies (456, 459, 496) that indicated higher level of physical inactivity among Iranian women in Iran. Thus if we can ignore possibility of selection bias in this pilot study, the findings imply that Iranian migrant women have a considerably improved physical activity level compared to their age matched

counterparts in Iran. Thus while even a considerably higher proportion of Iranian women reported to do sport (compared to Iranian men and Edinburgh White women) but probably most of them do not adhere to the recommended moderate or vigorous activity level on at least five days of the week. The findings also suggest that Iranian men in Edinburgh might be more at risk of the consequences of the sedentary unhealthy life style compared to Iranian women and also their age matched controls in Edinburgh.

Iranian migrants in this pilot study reported a higher consumption rate of meat products and lower consumption of fruits and vegetables in their daily diet. Such an imbalance in diet could potentially have major side effects on their health especially with the observed level of physical inactivity among them.

In relation to alcohol drinking behaviour about 76% of Iranian men and 52% of women in Edinburgh reported to drink alcoholic beverages occasionally or on a regular basis. These rates are still lower than the reported alcohol drinking rate in the age matched Edinburgh White men and women. There is a strong sense of stigma with alcohol use among some of the Iranians in Iran and those who drink alcoholic beverages are very conservative in talking about their drinking behaviour for strangers particularly for one of their counterparts. Consequently self reported data about drinking of alcoholic beverages should be considered carefully specially for women since such stigma for female drinkers is much stronger than the male drinkers. Under-reporting therefore is probable when asking question about Iranians drinking behaviour especially with regard to the frequency and quantity of alcohol use. For instance in the only published article in recent years (503) which included alcohol consumption, the rate (unstandardised) was 7.2% for men and 0.1% for women in the Golestan province of Iran.

Iranian men and women in Edinburgh indicated a higher rate of smoking compared to their counterparts. The difference in the women subgroup was substantial (13% versus 0.9%). Presence of a same stigma for smoking women in the Iranian community which exist for alcohol drinking warrants consideration of measurement bias in the interpretation of the results. Smoking for Iranian women is considered to be a Western behaviour and so is not a social norm within the Iranian community. It should be accepted however, that the observed smoking rate among Iranian women in Tehran

(about 1%, 95% CI: 0.2-4.9%) which is concurrent with the pooled estimated of smoking rate for Iranian women (1.25%, 95% CI: 0.6-2.4%) (see chapter four) might reflect a degree of conservatism in responding questions about smoking behaviour. Thus use of self-reported smoking data may cause a major bias in the research findings. But even with confirming presence of such conservatism, the observed difference is considerable and should not be interpreted solely based on the probability of under-reporting. It is not possible however, to judge about magnitude of this stigma on the observed difference until a reliable method is used to identify smokers in the Iranian studies. Higher self reported smoking rate of Iranian men compared to Edinburgh White men also needs to be addressed and investigated further using more reliable methods to detect smokers from absolutely non-smokers. The difference can also be explained by the presence of selection bias in the recruitment stage of this pilot study where people with higher rate of smoking made themselves volunteer to participate because of their prior knowledge about relationship between smoking and cardiovascular diseases. This study was unable to confirm or reject any of these hypotheses.

Iranian migrants in Edinburgh indicated higher mean levels of systolic and diastolic blood pressure and also prevalence rate of hypertension compared to their counterparts in Iran. Mean SBP level of Iranians especially in the male subgroup was higher than the estimated pooled mean of SBP using the data from Iranian studies (see chapter four). In the female subgroup the observed mean SBP was almost similar to the pooled estimate of the reported SBP in the Iranian eligible studies (see chapter four). Prevalence of hypertension among Iranian women in Edinburgh was notably lower than their age matched controls in Edinburgh. Bias due to use of different BP monitors in different studies is an important probability and variations in the results due to use of divergent measurement methods should not be completely ruled out. In any large scale future study issue of selection bias and mentioned limitation needs to be considered carefully and use of identical BP monitors or calibration of the new devices must be programmed in advance. Other hypothesis like diet change including a higher rate of alcohol consumption and smoking rate especially among Iranian migrant men may also explain their increased level of SBP compared to their counterparts in Iran.

In relation to the anthropometric indices Edinburgh's Iranian and White men were taller than the Iranian men in Tehran but at the same time they had higher mean weight level. Thus the excess weight affected their anthropometric profile. Such pattern was not observed among females since Iranian women in Edinburgh had lower weight than their counterparts in Iran and also than the Edinburgh's White women. Mean height of Iranian female migrant in Edinburgh also was higher than the mean height of Iranian women in Iran. Thus it can be concluded that Iranian female migrants in Edinburgh benefited significantly with their migration in relation to their weight however healthy migrant effect could be another important contributing factor.

The difference between hip and waist circumference of Iranian women in Edinburgh and two other comparison groups was statistically significant while waist to hip ratio did not show any meaningful variation. Iranian women in Edinburgh had narrower waist and hip circumference from both White women in Edinburgh and Iranian women in Iran.

Iranian men in Edinburgh were not very different from their counterparts in relation to the waist and hip circumference but their hip circumference was significantly narrower than the Edinburgh's White men. Accordingly since larger hip circumference has protective effect on CVD (556) it is predicted that Iranian migrant men in Edinburgh might be in a higher risk of CVD especially with their lower level of physical activity.

HDLc level in Tehran population was lower than the level of HDL-C in Edinburgh Iranian population. Accordingly it can be suggested that Iranians' HDL-C level increases with migration especially in women due to the factors like better access to physical fitness facilities and change in diet. A higher triglycerides level and TC/HDLc ratio among Iranian in Tehran may also confirm this hypothesis. Having a healthier diet and as indicated more physical activity by Iranian men and women probably are the most important influential factors in improving lipid profile of the Iranian migrants in Edinburgh. Being target of health education programmes and social pressure to be fit and healthy can also be other contributing factors. Iranian migrants in Edinburgh have a very similar lipid profile with the Edinburgh' White population which indicate that they are not at added risk of hyperlipidaemia.

Analysis of fasting blood glucose was indicated that about 2% of Iranian men and none of women in Edinburgh were diabetic. Also none of Iranian women reported to have doctor diagnosed diabetes. Presence of impaired fasting glycaemia was also seen among 6.3% of men and about 4.5% of women. Although these later figures should be confirmed by the 2 hours post glucose load test but since doing of this test was not proposed in this pilot study in any future study it should be applied to make precise judgement possible. If these findings were true then we can conclude that Iranian male migrants are in higher risk of diabetes when compared to Iranian women. Previously calculated overall prevalence of diabetes in Iran (about 6.0% in men and 7.0% in women) does not confirm such a difference (see chapter four). Effect of selection bias in the observed and reported rate of diabetes in the female subgroup and most importantly effect of small sample size should not be disregarded. Adjustment of results to some of the baseline confounding factors such as BMI or waist circumference can provide a better view of diabetes in the Iranian migrant population in future large scale study.

It was indicated that the analysis of data collected based on matching criteria using conventional methods with ignoring matching did not change the prevalence estimates considerably compared to use of matching techniques. Thus one potential application of the data collected in this pilot study in line with the progress in the matched analysis of the data collected in the cross-sectional studies with one case to many variable controls design could be comparison of the different analysis model on the point estimates of PRR and their 95% confidence intervals.

In this study for the first time CVD risk profile of Iranian migrants was investigated in the UK and their status was compared with age and sex matched controls from Edinburgh White and Iranian indigenous population. Such a comparison was not conducted before and its findings can give us an insight about priorities in health care provision and research field. Major limitation of this study was use of non-randomly selected sample of Iranians in Edinburgh for which there was not other choice due to lack of a reliable sampling frame. Thus it is probable that these results were affected by the selection bias. Small sample size of the recruited Iranians in this study was also made the findings and comparisons less precise.

With observed higher educational and occupational profile in the Iranian migrant group it was expected that they also have a better CVD profile compared to the indigenous White population. But this pilot study was unable to confirm such a difference. Thus it is probable that the Iranian general migrant population even have a worse CVD risk status than the currently identified levels.

To have a better view about health status of Iranians in UK and other countries of the world findings of this pilot study should be applied to plan and conduct a future large scale study on a representative sample of Iranians. According to the results of this pilot study while Iranian migrants have a better profile regarding some of the CVD risk factors compared to their counterparts in Iran but are in a added risk with regard to a number of CVD risk factors compared to Edinburgh indigenous White population. But their pattern of life style change and also CVD risk after migration need to be clarified further. In the next chapter an extensive overview about the main findings of this pilot study is given in relation to the health of Iranian migrant population and implications of these results on the ways any future large scale study can be conducted.

7.15 Abstract

Introduction: In this chapter findings of the conducted pilot study in relation to the prevalence of major cardiovascular disease risk factors were compared with two other age and sex matched data sets: one from Scottish Health Survey 2003 and the other from Tehran Lipid Glucose Study 2002 as an exemplar study from Iran. Such a comparison and following discussions can shed light on priorities and the way a future large scale study on the health of Iranian migrants can be conducted.

Methods: Conventional statistical methods (by ignoring the matching criteria) were used to analyse and discuss possible differences between the comparison groups. Mean difference and where appropriate geometric mean difference for quantitative variables and the prevalence rate ratio (PRR) for the dichotomous variables were calculated. To see how analysis of the matched data based on the matching techniques will change the analysis result conditional logistic regression model (fitted via Cox regression model) was also applied to analyse data of a number of variables with dichotomous exposure.

Results: A higher proportion of Iranian migrants in Edinburgh possess an academic qualification than the general White population and also Iranian in Tehran. A trivial difference was seen between the Iranian men and the Edinburgh's White men regarding the employment rate. Notwithstanding employment rate among the Iranian migrant women was about 15% lower than the Edinburgh's White women. While Iranian migrants indicated a better profile regarding some of the CVD risk factors (lipids, physical activity) compared to their counterparts in Iran but prevalence of hypertension, overweight or obesity and smoking was high among Iranian men in Edinburgh compared to their counterparts in Iran and also matched White controls.

Conclusion: The findings provided a better view about health status of Iranians in UK and other countries of the world. But many unanswered questions like a higher smoking rate and hypertension among Iranian women in Edinburgh compared to their age matched controls in Tehran remained to be answered. This study results can be used to plan and conduct a future study on a representative sample of Iranians.

Chapter Eight: Overview of the key findings from the two systematic reviews and pilot study on the prevalence of the cardiovascular disease risk factors among Iranians in Edinburgh

8.1 Introduction

The rationale behind choosing this study topic, its aims and objectives, methodologies used and results of the data analysis were provided separately based on a comprehensive review of the relevant literature in the previous chapters. The study findings also were discussed generally in chapter six and in relation to the CVD risk factors in chapter seven. This chapter gives an extensive overview about what this study added to the scientific literature in relation to the health of Iranian ethnic minorities throughout the world and also about implications this study may have on the ways any future large scale study on Iranian migrants can be conducted. Limitations in implementing population-based health studies across the Iranian communities abroad and major methodological issues researchers may consider in their work on Iranian migrants are also discussed in this chapter.

8.2 Main findings of the systematic reviews and pilot study

8.2.1 Findings related to the research methods on Iranian migrants

Two systematic reviews and a pilot prevalence study were conducted to gain experience and learn lessons to inform a future large scale study on Iranian Diaspora. In the systematic review of the methods and themes of health-related research on the Iranian Diaspora few studies were found but considerable heterogeneity in the

methodologies used. (297) The results also revealed that different recruitment methods in varying circumstances may lead to differing results. Distaste of Iranian migrants for written surveys and their suspicion of strangers asking questions were reported in some studies. (299, 313) But findings of this systematic review indicated that Iranians in general are cooperative with researchers and they are not characteristically reluctant to participate in health studies. However, the limited number of health related studies on Iranian migrants (297) implies inadequacy of our knowledge to have an explicit analysis about health status of this ethnic minority group. Therefore, with the growing population of Iranian migrants throughout the world, it is vital to move beyond boundaries of our current understandings about the health status of this ethnic minority.

Results of the second systematic review on the prevalence studies of cardiovascular risk factors among Iranians indicated a major heterogeneity in the methodologies used and divergent reporting quality. Also there was only limited number of studies on the prevalence of CVD risk factors among Iranian migrants. Thus, reliance solely on the results of these meagre and divergent researches to judge about CVD risk status of Iranians in Iran or abroad can be misleading. Without disregarding this limitation, the calculated pooled prevalence rates for some of the conventional CVD risk factors (e.g. obesity in women and abnormally low level of HDL-C in men) suggested that conducting of future precise studies both in Iranian indigenous and migrant populations can be enlightening.

With this background and to prepare for a large scale study on the prevalence of CVD risk factors among Iranian migrants in UK or other European countries a pilot study was conducted. According to the findings major reservation to participate in a health study was not found among Iranians in Edinburgh. In this study 87.5% of the respondents consented to give their own and 79.2% their family members' or friends' contact details (with their permission) to be recorded for invitation in a possible future study. While a majority of recruited Iranians in this pilot study indicated their willingness to cooperate in future health studies, but concerns of at least a fraction of Iranian migrants need to be investigated. The overall judgement is that conducting a future large scale population-based study on Iranian migrants is feasible. But in order to do such a study, creating a

list from names and contact details of Iranians residing in the major cities of the Scotland or whole UK will be pivotal. Even so, lack of a sampling frame of Iranian migrants' names or addresses in destination communities and also not having easily identifiable names that are specific for Iranians can make conducting of research on Iranian Diaspora challenging. Despite reported lack of engagement by some of the Iranians in earlier health studies, (299, 313) findings of this pilot work may readdress the assumption that such a hesitation probably stem from applied methodology or study limitations per se rather than a characteristic reluctance of Iranians to be recruited into health studies. These limitations in line with the restriction in the opening hours of the study clinic were probably influential in the relatively long recruitment stage of the Iranians into this pilot study. All these restraints however, may also be regarded as indications to label Iranian migrants a hard-to-reach ethnic group.

A number of respondents stated that they prefer to introduce themselves British when filling formal documents because of a degree of discrimination that they feel exist against ethnic minorities. Such a constraint can be a main concern in identifying Iranian migrants who will be questioned through indirect methods (e.g. postal questionnaire or electronic questionnaire) in future studies. This is especially important when we already know that about 72% of Iranian migrants in Edinburgh stated their ethnicity as "White" or "Other South Asian" during the Scotland Census 2001. (520) Therefore it is suggested to avoid application of a unique question as a proxy for ethnic classification of Iranian migrants in future studies. Such an inaccuracy also was seen with question about faith and religion when interviewing Iranian minority groups. The study findings indicated that at least for Iranian migrants, answers to the posed question about ethnicity or religion may not lead to straightforward answers. Not different from other population-based studies on ethnic minorities (557-559) results of this pilot study also revealed that preference for a same gender practitioner in all kind of examinations or examination of private area (including waist and hip measurement) should be regarded as a potential cultural barrier against participation of Iranian migrants in health studies.

The study results indicated that most of the Scottish Health Survey questionnaires can be adapted for the Scottish Iranian population. About 45% of the study informants stated

that they prefer a Persian questionnaire or an interview in Persian language in a future health study. While both optional original English and a translated version of the study questionnaire were available for study participants but regarding cross-cultural conceptual matters which is generally arise (560) when using directly translated version of questionnaires planned in English language, validation of the translated questions should be considered seriously for future studies.

Further research is needed to develop culturally sensitive methods to study Iranian migrants but before this happens involving of native multilingual Iranian researchers who are familiar with culturally sensitive issues and are oriented to Iranian customs, and also approaching key persons (those with extended network of friends) can be important in recruitment of Iranian subjects into health studies. Appealing to urgency of some health issues among Iranian communities abroad and that Iranians were not generally included like other ethnic minorities in studies which investigated prevalence of serious health problems (297) may also positively affect recruitment of Iranians into health studies.

8.2.2 Findings related to the prevalence of CVD risk factors among Iranians in general and Iranian migrants in particular

Cardiovascular diseases are the main cause of death in the UK and account for about 208,000 deaths annually. (561) Despite reduction of death rates from CVD in the UK since the early 1970s among more developed countries after Ireland and Finland the deaths rates in UK still is highest and this country has a top position among developed countries mortality league table. (562) This is while even within the UK there are regional differences regarding the prevalence of CVD and CHD and their consequences with Scotland having the highest death rate from CHD. (561) In addition to the regional differences ethnic variations are also reported in relation to the CVD related deaths in UK. South Asians including Indians, Pakistanis and Sri Lankans for instance have been indicated to suffer from a higher premature death rate of CHD than average population but those from Caribbean and West Africa reported to have much lower death rates than the average. (561)

Due to lack of empirical evidence about the CVD risk of Iranians in UK it is not possible to compare their status with general White or other ethnic populations. However, findings of the study can give us an overall view and in part be potentially applied for such a comparison. It should be noted that the statistical comparisons applied in this pilot study were for illustrative purposes only and due to differences between the studies, such comparisons must be interpreted with extreme caution.

According to the study results Iranian males in Edinburgh had an overall worse CVD risk factors profile than the Edinburgh White men. While for instance prevalence rate of hypertension, overweight or obesity and TC/HDL-C ratio were more or less same in the two comparison groups but regarding smoking rate and low HDL-C level Iranian men had a worse prevalence rate compared to Edinburgh White men (see Figure 7.1). In the female subgroup Iranians with regard to the prevalence of smoking, hypertension and overweight or obesity rate had a better status but a worse condition regarding the high TC/HDL-C ratio and low HDL-C level.

Iranian males except for high TC/HDL-C ratio and low HDL-C level also showed a worst CVD risk factors profile than their age matched counterparts in Iran. This is while in the Edinburgh Iranian women in addition to a better TC/HDL-C ratio and HDL-C level, prevalence of overweight and obesity was also lower compared to age matched Iranian women in Tehran (see chapter seven).

The probability of bias towards over-representation of educated and high risk people cannot be ruled out due to non-random selection of the respondents. But putting all this information together and considering the UK and Scotland's worse CVD profile compared to most other developed countries we can conclude that Iranian migrants are probably a high risk group for at least some of the important CVD risk factors.

8.3 Strength and weaknesses of the conducted studies

8.3.1 Strength and weaknesses of the systematic reviews

The systematic review of recruitment methods in health studies of Iranian Diaspora was a major initiative to understand the factors that persuade or inhibit Iranians living abroad to participate in a health study.

In this systematic review literature written in English or Persian language was searched while a sizeable number of Iranians are living in countries where other languages are used. Therefore articles or reports that may be published in local languages (France, Denmark, Germany, Norway and Sweden) were probably missed. Thus researchers should try to expand the search domain to the non-English/Persian language in any future similar study.

Findings of the second systematic review which was on all the CVD risk factor studies ever undertaken on the Iranian indigenous population or all Iranian migrants (see pages 81-134) should be interpreted with caution due to observed heterogeneity of applied methods. However, the findings can be considerably informative as a major prerequisite for planning a future epidemiological research on the prevalence of CVD risk factors among Iranian migrants or even Iran's indigenous population. The results indicated only a few comprehensive studies on the prevalence of CVD risk factors in Iran with substantial heterogeneity in the methodologies applied. Also only few studies were identified to investigate health status of Iranian migrant population and among them even very few focused on the prevalence of CVD risk factors in this ethnic group. With this background findings of this review may not generalise to Iranian population or all Iranians living abroad but nonetheless they provide a consistent overall picture about the extent of research had been performed on Iranians with regard to CVD risk factors and their potential credibility in giving a reliable impression about the CVD risk status of Iranians in Iran and abroad.

An extensive search had been done in this review to find out possibly all relevant studies, regardless of their publication place and language (English or Persian) but some limitations warrant to be addressed. Unfortunately due to limited number of eligible studies in the review it was not possible to analyse the findings for publication bias. But with observed heterogeneity in the applied methodology it is very likely that the observed variations in the findings were produced by these divergences in the methodologies rather than a chance. Thus in order to have reliable pooled estimates from the prevalence of CVD risk factors, it will be crucial for future researchers to comply with a standard protocol in doing research on the prevalence of CVD risk factors

especially in Iran. Few authors reported participation rates or explained characteristics of those refused to participate in a study. Many of the included articles had poor reporting quality. Every effort was made to track down unpublished studies and grey literature but this research is unable to rule out the possibility of publication bias entirely. Having access to a copy of full results from presented abstracts in conferences or brief summary of results in informal publications was not always successful. The strength of the review could be greatly improved if it was possible to have remote access to all journals or thesis had been published in Persian mostly in Iran (or to the databases of studies' title or abstracts) which is not possible currently due to lack of infrastructure to have access to the published works in this country electronically.

8.3.2 Strength and weaknesses of the pilot study

Findings of the above mentioned systematic reviews were used to plan a pilot study on the prevalence of CVD risk factors among Iranians in Edinburgh. This pilot work according to the best of current knowledge is the first study of its kind on Iranian Diaspora in the UK and is unique regarding the type and number of CVD risk factors studied. The study results represent extent of the prevalence of CVD risk factors in the Iranian Diaspora and important methodological issues that must be considered in future research on this ethnic group.

Use of non-random sampling method for recruitment of the study participants was a major limitation in this study. But the study results indicated no major difference between age structure of the recruited people with the age structure of Edinburgh's Iranians based on the Scotland 2001 Census data. Since a multi-method sampling approach was used to recruit people into the pilot study calculation of participation rate among those who received or saw the study flyer or those who heard about the study from their relatives or friends was not possible. Thus it is not possible to completely rule out probability of selection bias in the recruited sample.

For the first time the questionnaires had been used in the Scottish Health Survey 2003 were translated into Persian to provide freedom of choice for the study participants. Although face validity of the translated questionnaires was checked by one of the study

supervisors but cross-cultural validity of the applied questionnaires should be scrutinised in any future large scale study.

Recruitment stage of this pilot study started at 29/08/2006 and continued until 15/06/2007. There is some evidence supporting seasonal variations of selected biomarkers of CVD including lipid profiles. (120-124) Nevertheless, due to the small sample size and uneven availability of the study participants to attend the study clinic it was not possible to control effect of this possible confounding factor in this study.

Every effort was made to relax people before starting blood pressure measurements (by explaining advantages of participation in the study or talking about general topics like whether or sport events...) but probability of “white coat effect” (72) can not be ruled out in the blood pressure measures. A digital sphygmomanometer was used in this study to measure blood pressure. Results of this pilot study were compared with the findings of an exemplar study from Iran (416) for comparison purposes. In the Iranian study a conventional mercury sphygmomanometer was used to measure blood pressure but since its model was not provided in the study report it was not possible to validate blood pressure measures from two studies before comparison.

Owing to the presence of a kind of stigma in the Iranian community in relation to smoking among women, the applied self-report method in this study probably did not provided accurate data and so more reliable methods (e.g. measuring amount of carbon monoxide in breath with a portable monitor) (76) must be approached to identify reliably smoking Iranian women in future studies.

Another limitation for this pilot work was impracticability of comparison between the applied laboratory and analysis technique of blood lipids in the three studies. Since the analyses were conducted in different time frames and more importantly details of measurement protocols were not completely similar in the identified studies it is highly probable that different lipid analysis methods have given us divergent results for same level of lipid profile.

Some of the discussed limitations were in part inevitable due to proposed study design and comparison of the findings from three different studies in which no single standard protocol was followed for the variables measurements. But where possible researchers

should be aware of these limitations and try to avoid or control their effect in future large scale studies through applying standard measurement protocols or adjusting the measures by the appropriate equivalence scale.

8.4 Results of the study in relation to the scientific literature

This study indicated that Iranian migrants are under-represented in health studies as there are sizeable groups of Iranians in some of major destination countries. The issue of exclusion of ethnic minorities from health research has also been highlighted in the study of Bartlett et al. (563) They have suggested that under-representation of population subgroups in research are associated with differences in underlying factors and risk levels including socio-demographic status. They also have concluded that the issue of diversity in inclusion or exclusion of ethnic minorities in health studies is not very clear among researchers and for this reason it is generally ignored. Ranganathan and Bhopal (564) in their study on 72 North American and European cardiovascular cohort studies also have shown that the process of inclusion/exclusion of ethnic minority groups generally was not emphasised in these studies. Hussain-Gambles et al. (565) have argued that exclusion of ethnic minorities from health-related research can affect external validity of the findings. The ongoing discussions about importance of different contributing factors in inclusion or exclusion of ethnic minorities in health studies, gives the overall impression (565-570) that migrants in general share common challenges while some challenges may be amplified amongst certain groups. Factors like age, language, social class, feeling of not belonging/mistrust, culture and religion are suggested to be key points in recruitment of ethnic groups into health studies. (571) Researchers' perceptions of these factors are also suggested to be consequential in their success to recruit ethnic minorities. (568) Wendler et al. (570) have found small differences in the willingness of different minorities to participate in health studies and hence, they have recommended to focus on equal access to health research for all groups rather than concentrating on one group and their attitudes toward participation in health studies.

Under-representation of ethnic minorities in research created debates about the causes and patterns of variations in cardiovascular disease and its contributing risk factors in different countries. Nonetheless, the conducted works have generated a large scientific literature with many interesting findings. (47, 48, 67, 239, 572-581) For instance, Lip et al. (572) suggested that epidemiologic profile of CVD among African Americans do not explain pattern of CVD morbidity and mortality among black Africans and black Caribbeans, both in Britain and in their native African countries. Forouhi et al. (573) have reported ethnic differences in levels of visceral adiposity, insulin resistance, and also other risk markers such as C-reactive protein (CRP), adiponectin and plasma homocysteine. Agyemang and Bhopal (574) have indicated heterogeneity of blood pressure level in the South Asian groups residing in the UK. Lemic-Stojcevic et al. (575) also reported a higher prevalence of hypertension in Black Caribbeans but a lower level of HDL-C and TGs compared to Whites in the UK. The observed CVD variations and similarities across ethnic groups may stem from genetic or environmental factors and their precise exploration can provide valuable information for planning interventional programmes.

Due to the discussed limitations CVD prevalence rates calculated in this pilot study were not directly and exactly comparable with the rates reported for Iranians by other investigators or with the figures reported for other ethnic minorities in UK. But pending a comparable definitive study and to give an overall picture of the status of CVD risk factors among Iranian migrants in Edinburgh, such a limitation has been set aside, albeit with extreme caution.

As discussed in chapter 3 and 4 health studies on the Iranian Diaspora are scarce. Due to the heterogeneity of published research calculation of an overall summary estimate for prevalence of different CVD risk factors was not possible. Therefore comparisons of findings from this pilot study are with results of other single studies.

The prevalence of abnormal high fasting blood glucose level ($\text{FBS} \geq 6.1 \text{ mmol/l}$) as an indication of impaired fasting glycaemia or even probable diabetes among female Iranians in this pilot study (4.5%) is almost similar with the findings reported (4.0%) for Iranian women in Sweden by Daryani et al. (320) However, there are differences in the

age range of two studied groups (30-71 in Edinburgh pilot study and 35-64 in the study of Daryani et al.). Also there is a time lag between the two studies (fieldwork of the Edinburgh pilot study was conducted in 2007 while in the study of Daryani et al. data gathering took place before 2005). (320) Direct or indirect standardisation of these rates is not possible due to lack of needed data about number of recruited women in different age groups in the study of Daryani et al or having a standard structure of Iranian migrants population. Thus our judgement is based on non-standardised prevalence rates. Same problems exist for comparison of the obesity prevalence rates in two studied groups, but crude rate for both Iranian women in Edinburgh and Sweden (Uppsala) was 13.0%. (320)

Self-reported smoking rate of Iranian men in Australia according to the study of Rissel et al. (305) was lower than their counterparts in Edinburgh (24.0% versus 30.6%) but in female subgroup it was higher (17.0% versus 13.0%). Such a difference should be interpreted with caution since the age range of target group was over 18 years old for both males and females in the study of Rissel et al. while in Edinburgh study it was 29-64 for males and 30-71 for females. Higher smoking rate of Iranian men in Edinburgh can be attributed to baseline factors responsible for a high smoking rate of indigenous population in Scotland. But this assertion should be investigated further regarding all problems which potentially may occur when comparing none standardised prevalence rates.

The prevalence of hypertension (according to the World Health Organisation criteria) among Iranian men in Edinburgh reported to be higher than Iranian men in Oslo, Norway (391) (22.5% versus 14.0%) however, the observed difference in the prevalence of hypertension among Iranian women in Edinburgh compared to the Iranian migrant women in Oslo (13.0% versus 11.0%) seems to be insignificant. The mean age, age standard deviation and age range of Iranian women studied in Oslo was 41.7 years, 7.2, 31-60 but for Iranian women in Edinburgh it was 44.2 years, 8.98, 30-71 respectively. A higher mean age of Iranian female subgroup in Edinburgh may explain the observed difference in the prevalence of hypertension but more robust interpretation needs to be based on further scrutiny.

Considering all limitations in calculating standardised prevalence rates, available data suggest that Iranian men in Edinburgh have the worst smoking rate (31%) after Bangladeshi men (40%) residing in England (561) and that smoking rate among Iranian women in Edinburgh is higher than the South Asian females. Obesity rate among Iranian men also was higher than the South Asian men living in England but lower among Iranian women in Edinburgh compared to the South Asian women. Prevalence of hypertension and diabetes however seems to be lower among Iranian migrants of both sexes in Edinburgh compared to South Asians and in a similar level with Edinburgh White and also England general population. (561) To be able to discuss these differences precisely, use of data from a randomly selected sample of Iranians abroad and application of standardised prevalence rates are suggested in future studies.

Findings of this pilot study herald the immense importance of a future large scale study to investigate health status of Iranian Diaspora. Two conducted systematic reviews indicated how sparse are our knowledge about Iranian migrants and how important are use of reliable methodologies in providing an accurate picture from the health status of Iranians abroad and also Iranians in Iran. Probability of selection bias towards inclusion of highly educated people was a major concern in this pilot work. Thus logically the higher educational level among recruited Iranians must indicate its impact on their better CVD risk profile. But even if we assume the studied sample as a relatively representative sample of Iranian Diaspora in UK (or even in Europe) it was evident that while CVD risk factor profile for Iranian men improves regarding some of the risk factors (HDL-C level and TC/HDL-C ratio) after migration, but it also gets worse simultaneously in relation to some other important risk factors such as smoking and hypertension. To be able to verify such a claim a large scale study on a randomly selected sample of Iranians abroad will be needed in the future.

8.5 Conclusions and recommendations

Findings of this pilot study indicate that there is no reservation among Iranians in a scale that prevents them from participation in health studies. So a large scale population-based study on Iranian migrants seems to be feasible. The study results also suggest that Scottish Health Survey questionnaires can be adapted for the Scottish Iranian

population. Due to the stated preference for Persian language as the questionnaires or interview language (by 44.4% of respondents), in any future study it is recommended that application of translated documents and also employment of multilingual interviewers can potentially increase success rate in recruitment and conducting of a population-based study on Iranian ethnic minorities. Therefore, validation of the translated questionnaires will be a top priority before application of these translated versions in any future study.

The results also revealed challenges researchers may face in recruiting Iranians into health studies. For instance informal methods e.g. word of mouth, contacting people through their friends and participating in Iranians gatherings to invite them for participation are suggested more frequently by the respondents than the formal methods (e.g. advertising in the media) for increasing participation rate.

The study findings indicated that application of a single and direct proxy question to identify Iranians' ethnicity in future studies may lead to incorrect answers. So use of a group of questions like birth place, mother language, religion and number of years stayed in the country may give a better view about ethnicity of Iranian migrants.

The study findings highlighted importance of providing freedom of choice to select gender of practitioner when examination of the study participants is going to be performed in any future study on Iranian migrants.

This pilot study shed light on the pattern of the prevalence of a number of major CVD risk factors among Iranians settled in Edinburgh. Comparison of the collected data with the acquired data from an Iranian exemplar study in Iran and Scotland gave further information to assess patterns of changes in lifestyle and so in the prevalence of CVD risk factors after migration in this ethnic group. There are however, still debates about reliability and accountability of different CVD risk factors in the prognosis of CVD (112-119, 225, 228, 233, 234, 240, 244, 252, 255, 582-585). More than 93% of the study participants consented to give extra blood sample to be stored for further analysis of other CVD risk factors in the future. Therefore analyses of these frozen samples for some of the other recommended CVD risk factors (e.g. C-reactive protein, adiponectin or C-peptide) will be potentially informative in uncovering pattern of CVD risk among

Iranian migrants. Findings of such analyses can help researchers to base their decisions about priority of study variables on sound evidence in any future large scale research.

About 87% of the respondents in this pilot study were willing to allow their name and almost 79% of them consented to give their family members' or friends' contact details to go on a list of all Iranians in Scotland for a future health study of this kind. The results indicated that construction of a sampling frame of Iranians who reside in Edinburgh is feasible and the list which was prepared through this pilot study can be applied in future health studies after obtaining their formal consent.

Since number of available cases in this pilot study was small relative to the number of available controls, in order to increase relative efficiency of the comparison multiple matched control (1:5) design were applied where possible (otherwise variable numbers of controls (maximum 5) matched to each case). Primary analyses of the study data were performed using conventional method by ignoring matching criteria. Then analyses were repeated based on matching design for some of the quantitative variables using Conditional Logistic Regression (fitted via Cox Regression model) to see how the analysis model can affect the study results. These findings indicated that matched analysis of data collected in a matched design versus unmatched analysis will direct findings towards more conservatism (wider confidence intervals). Thus one potential application of the data collected in this pilot study in line with the progress in the analysis of the data gathered based on one case to many variable controls design could be comparison of the different analysis model on the point estimates of prevalence rate ratio (PRR) and their 95% confidence intervals in future.

8.6 Summary

The limited number of health related studies on Iranian migrants implies inadequacy of our knowledge to have an explicit analysis about health status of this ethnic minority group. Two systematic reviews and a pilot prevalence study were conducted to gain experience and learn lessons to inform a future large scale study on Iranian Diaspora.

A considerable heterogeneity was seen in the methodologies used within studies on Iranian Diaspora. Application of a multi-method recruitment approach; translation of the study questionnaire and declaration of consent in the respondents' language were

suggested to be helpful to increase participation of Iranians in population-based studies. A few comprehensive studies were identified on the prevalence of CVD risk factors in Iran with substantial heterogeneity in the methodologies applied. Only few studies were identified to investigate health status of Iranian migrant population and among them very few focused on the prevalence of CVD risk factors.

In the pilot study of the prevalence of CVD risk factors among Iranians in Edinburgh the questionnaires had been used in the Scottish Health Survey 2003 were translated and used to collect data. Blood pressure and anthropometric indices were measured and blood samples were analysed for lipids and fasting glucose levels. Iranian males in Edinburgh indicated an overall worst CVD risk factors profile than the Edinburgh White men. Smoking rate and low HDL-C level among Iranian men was worst than the Edinburgh White men. This is while Iranian males in Edinburgh had shown also a worst CVD risk factors profile than their age matched counterparts in Iran. In the female subgroup Iranians in Edinburgh had a better profile regarding the rate of smoking, hypertension and overweight or obesity but a worst condition with regard to the high TC/HDL-C ratio and low HDL-C level compared to Edinburgh White women. They also had a better TC/HDL-C ratio and HDL-C level compared to age matched Iranian women in Tehran with a sharp decline in the prevalence of overweight and obesity.

Without disregarding probability of selection bias we can conclude that Iranian migrants are probably a high risk group for at least some of the important CVD risk factors. The study results represent extent of the prevalence of CVD risk factors in the Iranian Diaspora and important methodological issues that must be considered in any future health related studies. The questionnaires had been used in the Scottish Health Survey 2003 can be adapted for the Scottish Iranian population. But regarding cross-cultural conceptual matters, validation of the translated questions should be considered in any future large scale study which is needed to resolve the remained uncertainties.

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Appendices

Appendix one: publications and presentations

A1. Published article

Diversity in Health and Social Care 2007;4:251–65

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Research paper

A systematic review of the methods and themes of health-related research on the Iranian diaspora: massive needs and opportunities

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ABSTRACT

There is an increasing Middle Eastern diaspora, of which Iranian migrants are a major group. They are dispersed within the general population in the destination countries; this, together with the fact that many are political migrants, makes conducting population-based studies on this minority group challenging. UK policy mandates that we provide equal access to health and healthcare for them. The research evidence on which to base healthcare planning and provision decisions for the Iranian diaspora is, however, very limited.

This study aimed systematically to review methods used in population-based health research on Iranians to learn lessons to apply to future planned epidemiological research. Nine databases were systematically searched and the references of relevant articles were scrutinised. Researchers known to have particular expertise of working with Iranians were contacted to help locate additional unpublished work and research in progress. Quantitative and qualitative studies on Iranians living abroad, but not in institutions, published in English or Persian, that reported recruitment strategy, sampling and data-gathering technique were eligible for inclusion.

From 30 potentially eligible articles, 13 unique studies satisfied our inclusion criteria. There was

considerable diversity in the questions posed, methodologies used and findings of these included articles. The topics included dental health, cardiovascular risk factors, sex roles, cultural identity and research methods. The study sample sizes ranged from 10 to 413 participants. Participation rate with snowball sampling ranged from 19% (postal questionnaires) to 99% (telephone interview); with convenience sampling from 33% to 57%; and using random sampling from 21% to 68%. Responders tended to be of higher socio-economic status than non-responders. Commonly, information on translation and cross-cultural validity of questionnaires was not reported.

This is the first systematic review of methods in health studies of Iranians living abroad. We found only a few studies and considerable heterogeneity in the methods and findings of these included studies. Although there is a growing population of Iranians abroad and study of determinants of health in this ethnic minority group is vital, this review shows huge gaps in the evidence base.

Keywords: ethnic group, healthcare, Iran, migrant, research, sampling, studies

Appendix one (continued)

Introduction

In studying ethnic groups as discrete communities, researchers are endeavouring to contribute to improving health and reducing health inequalities. However, they often encounter difficulties, particularly in identifying and recruiting the planned number of participants. There are many potential explanations for this, including lack of knowledge about the socio-cultural features of each individual ethnic group. A rigorous look at recruitment strategies and socio-cultural attributes of potential participants is therefore extremely important in the planning phase of research on ethnic minority groups. Research on Iranian populations living abroad provides one example of the difficulties that researchers may experience, and forms the subject of this article.

There has been increasing migration from Iran in the last three decades, and Iranians now form one of the largest groups in a growing Middle-Eastern diaspora. Iranian migration accelerated with the Iranian revolution in 1979 and was given added impetus by an eight-year war between Iraq and Iran, which began in 1980. Those who left Iran were generally wealthy and educated people compared to both the remainder of the population and the existing minorities, such as African-Caribbeans, Bangladeshis and Pakistanis, in the countries to which they were migrating. According to the statistics given by official resources (Migration Policy Institute, 2004), 135 383 Iranians migrated to the US, Canada, Germany, Netherlands, UK, Sweden and Australia during 1996–2000. However, the actual number of migrants of Iranian origin is likely to be higher than these official reports suggest. Although sizeable Iranian communities are now to be found in many western European countries, the number of population-based health studies on Iranians abroad is small, possibly because they are dispersed within the general population in the destination countries and have no easily identifiable forenames or surnames. Iran itself is a multi-ethnic and multicultural country and this background diversity is reflected in the language, lifestyle and living conditions of Iranian migrants overseas. Conducting population-based studies on this minority group is therefore challenging. The lack of studies on the Iranian migrant population is believed by some researchers, including the first author, to reflect a lack of willingness on the part of some Iranians, particularly political migrants, to participate in research for reasons that include fear of being identified. There is, however, no reliable summary of the empirical literature to substantiate this assertion.

This article presents a review of those population-based studies that have been conducted about Iranians living abroad, in order to ascertain what lessons can be learned and to aid the planning and implementation

of future research. The review focuses on sample size and recruitment strategies and also assesses the range of topics covered, and hence both the range of themes already studied and those that remain unstudied. The main question of this review is how other researchers have reached and recruited Iranian migrants into population-based health studies. Ultimately the review aims to help treat Iranian origin minorities equally in relation to research and access to health and health-care. As far as we are aware, it is the first systematic study of this subject in this population of its kind.

Methods

Types of studies

We used the MOOSE (Meta Analysis of Observational Studies in Epidemiology) guidelines to do this systematic review (Stroup *et al*, 2000). All epidemiological studies or qualitative studies or social surveys on Iranians living permanently abroad, thus excluding students and those living in institutions, were eligible if they were published in English or Persian and reported sample recruitment strategy, sample size and data gathering technique.

Systematic reviews of observational studies usually exclude qualitative studies. Although qualitative studies may not contribute to synthesis of quantitative epidemiological studies, in view of the suggestion that the lack of studies on the Iranian migrant population may reflect a lack of willingness on the part of Iranians to participate in research for reasons including fear of being identified, particularly among political migrants, we judged that qualitative studies on Iranians could be a rich source of understanding about their possible reluctance to participate in research, and highlight methodological barriers to recruiting Iranians overseas into population-based studies. Therefore, we included such studies. Further details about the types of data, outcomes and our search strategy are shown in Boxes 1–3.

Box 1 Types of data

The types of collected data included:

- demographic characteristics of studied sample (age, sex, status of residency and current place of living)
- sampling approaches in the eligible studies (sample size and recruitment strategy, sampling methods, sampling frame)
- study features (researcher, study subject and type, data-gathering technique and study implementation year)

Appendix one (continued)

Box 2 Types of outcome sought

Topics covered by studies were:

- number of studies on Iranians living abroad by country
- number of studies having good-quality information on methods (sample size, sampling method, sampling frame and recruitment criteria of subjects)
- type of recruitment strategies
- response rates
- main lessons from eligible studies that may help planning of future studies on Iranians abroad

Selecting studies

The review was limited to English and Persian language studies published between 1950 up to week 1, April 2006. Abdolreza Shaghghi checked the titles and abstracts of all retrieved records to distinguish relevant articles. Articles were excluded on initial screening if the title and the abstract showed that they were not reporting population-based studies on Iranians. When a title or abstract could not be rejected with certainty, the full text of the article was acquired

for further assessment. For those studies that were potentially relevant, full papers were secured. References of relevant articles were inspected. We also included studies recognised through serendipitous discovery. Researchers (Dr Sirous Momenzadeh, Dr Freidoon Khavarpour and Professor Haakon Meyer) well known to undertake research on Iranian populations were contacted for possible additional references. Reference Manager software was utilised, and duplicate entries were deleted. Studies were assessed for quality. A data-extraction sheet was used for summarising included studies (see Box 4).

Data extraction

The data were extracted into a customised data-extraction form. Descriptions of the problems encountered by the researchers in recruiting the study sample or recommendations to increase participation rate were also extracted.

Data presentation

Data were tabulated chronologically by country of study and presented in descriptive form. Response rate was calculated as a percentage of participants in the study in relation to the number required by the researcher.

Box 3 Search strategy

The following databases were searched:

- AMED (Allied and Complementary Medicine): 1985 to April 2006
- CINAHL (Cumulative Index to Nursing and Allied Health Literature): 1982 to week 5, March 2006
- EMBASE: 1980 to week 13, 2006
- Ovid MEDLINE(R):
 - 1950 to 1965
 - 1966 to 7 April 2006
 - in-process and other non-indexed citations, 6 April 2006
- CAB Abstracts: 1973 to March 2006
- Global Health: 1973 to March 2006
- Index to Theses (a comprehensive listing of theses with abstracts accepted for higher degrees by universities in Great Britain and Ireland since 1716): 1716 to 6 March 2006
- National Research Register (UK)
- International Bibliography of the Social Sciences: 1951 to week 1, April 2006.

The free texts and MeSH indexing terms were:

Iran or Iranian or Persian or Parsi\$ or Farsi\$ or Tehran\$ or Isfahan\$ or Shiraz\$ or "Fars province" or Ardabil\$ or Uromia\$ or Qazvin\$ or Tabriz\$ or Mashad\$ or Mashhad\$ or Khorasan\$ or Kerman\$ or Yazd\$ or Kermanshah\$ or Kordestan\$ or Zahedan\$ or Lorestan\$ or "Chaharmahal and Bakhtiari" or "Kohkiloieh va Boier Ahmad\$" or Gilan\$ or Mazandaran\$ or Zanjan\$ or Ahwaz\$ or Khozestan\$ or Sistan\$ or Bandarabbas\$ or Hormozgan\$ or Bushehr\$ or Golestan\$ or Semnan\$ or Markazi\$ or Hamadan\$ or Qom\$ or Qazvin\$ or Ilam\$) AND "ethnic groups" or ethnology or "Emigration and Immigration" or "Transients and Migrants" or "minority groups" or refugee\$ or abroad or "foreign country" or overseas.

Other electronic resources such as web pages of ethnicity-related organisations or official health organisations of countries known as having a fair number of Iranians and potentially pertinent internet sites (Google) were searched for unpublished materials.

Appendix one (continued)

Box 4 Quality criteria for assessment of internal and external validity

- Precise definition of study sample
- Clarity of data-gathering technique (e.g. application of original or translated questionnaires, language used in interviews)
- Referring to the location of data collection from study participants (e.g. home, office)
- Age, sex, state and length of residency in the host community
- Use of a representative sample of target group in the study
- Giving response rate for study

Results

The process by which 13 studies were included is shown in Figure 1 and described briefly below. Three-hundred and ten studies (including duplicates) were identified mainly from CINAHL (11 articles), EMBASE (83 articles), MEDLINE (109 articles), CAB (CAB abstracts database; 35 articles), Global Health (29

articles) and International Bibliography of the Social Sciences (42 articles). Review of the titles of these identified 70 potentially pertinent articles. Review of the abstracts led to 24 studies which apparently met the inclusion criteria, but the full texts showed 20 studies met the initial inclusion criteria.

A further 56 candidate articles were identified by reviewing the references of these 20 articles, and nine had potential for inclusion. One study resulted from serendipitous discovery of unpublished work presented in the Sixth International Conference on Preventive Cardiology (Meyer and Kumar, 2005). An internal report from the Institute for Social Anthropology in the University of Bergen, Norway (Kamalkhani, 1998) was not obtainable although the request was sent to the email address given on the Institute website. There was considerable diversity in both methodology and reported data in the potentially eligible articles. To learn every lesson about application of different methods in recruiting Iranian ethnic groups, we decided to exclude only those studies in which Iranians were not regarded as a separate group in the data analysis and reporting of the findings. We also excluded those studies in which it was not clear from explained methodology of the article whether the studied group

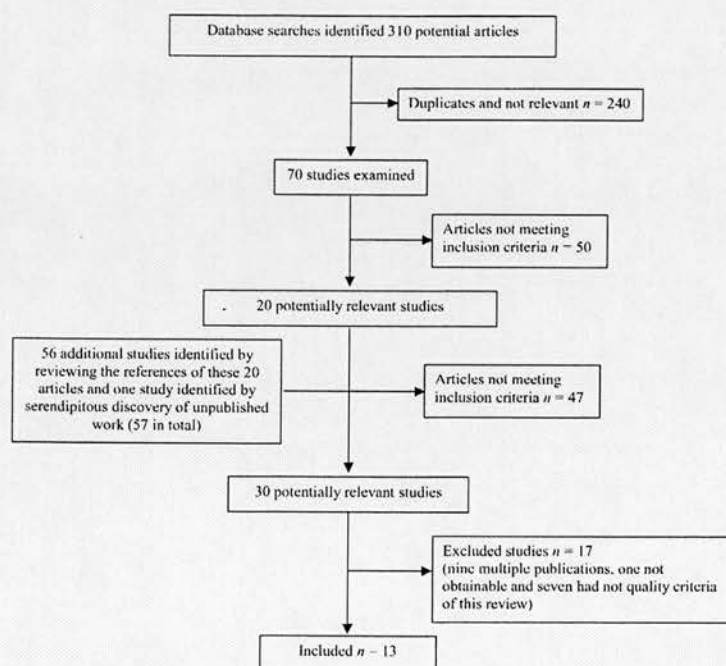


Figure 1 Study identification and selection process in the systematic review of the methods and themes of health related research on the Iranian diaspora

Appendix one (continued)

of Iranians settled in a permanent base in the host community. Furthermore, we considered the quality of included studies based on above-mentioned quality criteria in the results section.

In six studies (Meleis *et al.*, 1992; Lindström *et al.*, 2001; Lindström and Sundquist, 2001, 2002; Dawson *et al.*, 2005; Lindström, 2005), Iranians were a part of the study sample, but as part of a group of 'immigrants from other countries', and were therefore not analysed separately. One article (Ghaffarian, 1987) was on college students but since it was not clear from the full text whether these Iranian students were spending a length of time at their place of study or had grown up in the host country, it was excluded (see Appendix 1).

Correspondence with other researchers did not add to the list of relevant studies. Of the 22 articles that met our criteria, seven (Hjern and Grindefford, 2000; Sundquist *et al.*, 2000; Bayard-Burfield *et al.*, 2001; Hjern, 2001; Hjern *et al.*, 2001; Wandell *et al.*, 2004; Wiking *et al.*, 2004) were publications from the Immigrant Survey of Living Conditions in four minority groups of Sweden. Two studies from Australia (Khavarpour and Rissel, 1997; Rissel and Khavarpour, 1997), two from the Netherlands (Gerritsen *et al.*, 2004, 2006) and two from Norway (Holvik *et al.*, 2005; Meyer and Kumar, 2005) were publications based on data from one study. Since methodologies for sampling, recruiting and participation rate in different publications from same study are identical, we decided to include one sample study from each study. Thus, 13 studies, including three qualitative studies (Momenzadeh and Posner, 2003; Higgins, 2004; Barnes and Almasy, 2005), were the focus of this review (see Table 1).

Studies reporting data

The topics included dental health, cardiovascular risk factors, sex roles, cultural identity and acculturation, healthy behaviour, mental health, vitamin deficiency and research methods. Eight studies (Hanassab, 1991; Chaichian, 1997; Rissel and Khavarpour, 1997; Mahdi, 2001; Momenzadeh and Posner, 2003; Yavari *et al.*, 2005; Barnes and Almasy, 2005; Daryani *et al.*, 2005) were implemented by authors with Iranian names. The studies took place in six countries: Australia with two (15.4%), Canada with one (7.7%), Netherlands with one (7.7%), Norway with one (7.7%), Sweden with two (15.4%) and US with six (46.1%). In the Canadian study, methods for creating a list of Iranians through linking specific surnames and given names were described. Sample size among the other 12 studies was in the range of 10–413 participants. Convenience sampling (Hanassab, 1991; Chaichian, 1997; Higgins, 2004), snowball sampling method (Lipson, 1992; Rissel and Khavarpour, 1997; Momenzadeh and Posner, 2003; Barnes and Almasy, 2005), inclusive sampling

(Holvik *et al.*, 2005) and random sampling (Hjern and Grindefford, 2000; Mahdi, 2001; Daryani *et al.*, 2005; Gerritsen *et al.*, 2006) methods were used. Participation rates in studies that used snowball sampling ranged from 19% with postal questionnaires to 99% with telephone interview. Participation rates were 33.3–57% in studies that used convenience sampling methods, 21.3–68.1% in studies with random sampling methods and 38.8% where inclusive sampling was used (Holvik *et al.*, 2005).

The data-gathering technique, study site, use of translated or original questionnaires and language in the interview are provided in Table 2.

Postal questionnaire and face-to-face interview were used simultaneously in three studies (Hanassab, 1991; Lipson, 1992; Chaichian, 1997; 25%). In five studies (41.7%) only face-to-face interviews were used (Hjern and Grindefford, 2000; Momenzadeh and Posner, 2003; Higgins, 2004; Barnes and Almasy, 2005; Gerritsen *et al.*, 2006). Telephone interviews were used in one study (Rissel and Khavarpour, 1997; 8.3%). Self-administered questionnaires along with clinical examination and para-clinical tests were applied in two studies (Daryani *et al.*, 2005; Holvik *et al.*, 2005; 16.7%). In one study (8.3%), only a postal questionnaire (Mahdi, 2001) was used.

The place for data gathering, among eight studies using face-to-face interview, was not reported in two (25%) articles (Lipson, 1992; Chaichian, 1997), it was the participants' homes in four studies (50%) (Hjern and Grindefford, 2000; Momenzadeh and Posner, 2003; Barnes and Almasy, 2005; Gerritsen *et al.*, 2006); while in two studies (25%) both participants' homes and researchers' offices were used (Hanassab, 1991; Higgins 2004).

In two studies (16.7%), clinical data were collected (Daryani *et al.*, 2005; Holvik *et al.*, 2005). Of six studies (50%) where postal or self-administered questionnaire were used (Hanassab, 1991; Lipson, 1992; Chaichian, 1997; Mahdi, 2001; Daryani *et al.*, 2005; Holvik *et al.*, 2005), three (50%) did not refer to translated questionnaires (Hanassab, 1991; Chaichian, 1997; Mahdi, 2001). In the remaining three studies (Lipson, 1992; Daryani *et al.*, 2005; Holvik *et al.*, 2005) translated questionnaires were used.

Telephone or face-to-face interview was reported in nine (75%) studies (specifically or in combination with other methods). In three (33%) studies (Lipson, 1992; Hjern and Grindefford, 2000; Higgins, 2004) both original and translated set of questions (optional) were used; and in one (Momenzadeh and Posner, 2003; 11%) only an English version of a questionnaire was used during interviews. To answer interview questions, interviewees in one (11.1%) study used Persian (Momenzadeh and Posner, 2003), in four (44.4%) Persian and English (Lipson, 1992; Rissel and Khavarpour, 1997; Higgins, 2004; Barnes and Almasy, 2005), in one (11.1%) Persian

Appendix one (continued)

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Table 1 Studies by country: type, title, sampling and response rate

Author(s)/type/year of study	Title of study	Study sample/frame/size	Sampling method	Response rate
Sweden	Hjern and Grindeford (2000), quantitative	Dental health and access to dental care for ethnic minorities in Sweden	Random sampling from Sweden's Register of The Total Population	68.1% (for Iranians) and 80.6% for Swedish
	Daryani <i>et al</i> (2005), quantitative	Risk factors for coronary heart disease among immigrant women from Iran and Turkey, compared to women of Swedish ethnicity	Random sampling from Swedish Statistical Agency Register	79% for Iranian and 54% for Swedish women
US	Hanassab (1991), quantitative	Acculturation and young Iranian women: attitudes toward sex roles and intimate relationships	Convenience sampling	Not stated
	Lipson (1992), quantitative	The health and adjustment of Iranian immigrants	Snowball sampling	Not stated for those invited for interview, and 19% for postal questionnaire
	Chachian (1997), quantitative	First-generation Iranian immigrants and the question of cultural identity: the case of Iowa	Convenience sampling	57%
	Mahdi (2001), quantitative	Perceptions of gender roles among female Iranian immigrants in the US	Random sampling from one cultural and two scholarly associations	21.3%

Appendix one (continued)

Table 1 Continued

	Interviewing Iranian immigrant parents and adolescents	Iranian families residing in Santa Clara County who have school-aged adolescents (<i>n</i> = 101)	Convenience sampling	About one-third of eligible families
Higgins (2004), qualitative				
Barnes and Almasry (2005), qualitative	Refugees' perceptions of healthy behaviour	Adult refugees (males and females) aged 19–71 years, from Cuba (<i>n</i> = 10), Bosnia (<i>n</i> = 11) and Iran (<i>n</i> = 10)	Snowball sampling	91% (overall)
Australia				
Rissel and Khavarpour (1997), quantitative	An application of 'snowball' sampling among a small dispersed migrant population for health research	Iranian-born migrants (males and females) aged over 18 years living in Sydney (<i>n</i> = 413)	Snowball sampling	99%
Momenzadeh and Posner (2003), qualitative	Iranian migrants' discourses of health and the implications for using standardised health measures with minority groups	Iranian migrants (males and females) residing in Australia aged 25–60 years (<i>n</i> = 31)	Snowball sampling	Not stated
Netherlands				
Gerritsen <i>et al</i> (2006), quantitative	Physical and mental health of Afghan, Iranian and Somali asylum seekers and refugees living in The Netherlands	Asylum seekers (residing in The Netherlands) and refugees (residing in three municipalities of Arnhem, Leiden and Zaanstad) born in Afghanistan, Somalia and Iran (<i>n</i> = 410)	Random sampling from population register	53% for Iranian refugees
Norway				
Holvik <i>et al</i> (2005), quantitative	Prevalence and predictors of vitamin D deficiency in five immigrant groups living in Oslo, Norway: the Oslo Immigrant Health Study	Migrants aged 31–60 years born in Turkey (<i>n</i> = 87), Sri Lanka (<i>n</i> = 155), Pakistan (<i>n</i> = 94), Vietnam (<i>n</i> = 47) and Iran (<i>n</i> = 108) living in Oslo	Inclusive sampling (random sampling for Pakistanis)	38.8 % for Iranians
Canada				
Yavari <i>et al</i> (2005), quantitative	Methodology to identify Iranian immigrants for epidemiological studies	NA	NA	NA
NA, not applicable.				

Appendix one (continued)

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Table 2 Studies by country: title, data collection and language

Title of study/author(s)/publication year	Data-collection technique	Data-collection place	Language of questionnaires	Language in interviews
Sweden				
Dental health and access to dental care for ethnic minorities in Sweden. Hjern and Grindeford (2000)	Face-to-face interview	Participants' homes	Translated version of (Persian) and Swedish on request	Persian in 10% of cases, Swedish in 90% of cases
Risk factors for coronary heart disease among immigrant women from Iran and Turkey, compared to women of Swedish ethnicity. Daryani <i>et al</i> (2005)	Self-administered questionnaire, clinical examination and paraclinical tests	Participants' homes and research site	Translated version (Persian)	NA
USA				
Acculturation and young Iranian women: attitudes toward sex roles and intimate relationships. Hanassab (1991)	Postal questionnaire or face-to-face interview	Participants' home or researcher office	Not stated	Not stated
The health and adjustment of Iranian immigrants. Lipson (1992)	Face-to-face interview and postal questionnaire	Not stated	Translated (Persian) and non-translated (English) version	Persian on request and English
First generation Iranian immigrants and the question of cultural identity: the case of Iowa. Chatchian (1997)	Postal questionnaire or face-to-face interview	Not stated	Not stated	Not stated
Perceptions of gender roles among female Iranian immigrants in the United States. Mahdi (2001)	Postal questionnaire	NA	Not stated	NA
Interviewing Iranian immigrant parents and adolescents. Higgins (2004)	Face-to-face interview	Participants' home, place of work and coffee shops or researcher's office	Translated (Persian) and non-translated (English) versions	Almost all in Persian
Refugees' perceptions of healthy behaviours. Barnes and Almasy (2005)	Face-to-face interview	Participants' home	NA	English and Persian on request

Appendix one (continued)

Table 2 Continued

Australia	Telephone interview	NA	NA	Persian in 90% cases, English in 10% of cases
An application of 'snowball' sampling among a small dispersed migrant population for health research. Rissel and Khavarpour (1997)				
Iranian migrants' discourses of health and the implications for using standardized health measures with minority groups. Momenzadeh and Posner (2003)	Face-to-face interview	Mostly at participants' home	English version	Persian
Netherlands				
Physical and mental health of Afghan, Iranian and Somali asylum seekers and refugees living in the Netherlands. Gerritsen <i>et al</i> (2006)	Face-to-face interview	Participants' place of living	Translated version of Persian	Persian or Dutch
Norway				
Prevalence and predictors of vitamin D deficiency in five immigrant groups living in Oslo, Norway: the Oslo Immigrant Health Study. Holvik (2005)	Self-administered questionnaire, clinical examination and paraclinical tests	Study site	Not stated	Not stated

NA, not applicable.

Appendix one (continued)

and Dutch (Gerritsen *et al*, 2006) and in one (11.1%) Persian and Swedish (Hjern and Grindeford, 2000). In two (22.2%) studies (Hanassab, 1991; Chaichian, 1997) authors did not refer to the language of interview.

Studies on research methods on Iranians

Three studies (Rissel and Khavarpour, 1997; Higgins, 2004; Yavari *et al*, 2005) discussed methodological aspects of doing research on Iranians abroad, as summarised in Table 3. Rissel and Khavarpour (1997) referred to obstacles to using more reliable sampling methods among Iranian migrants, such as being a small dispersed community within the original population, not having easily identifiable names or surnames, and the sensitivity of the study subject such as sexual behaviour or illegal drug use. They recruited four bilingual interviewers born in Iran representing different subgroups of Iranians. These interviewers then contacted eligible persons via the telephone to encourage them to answer study questions and to give telephone numbers of up to four adult friends or relatives, not immediate family members, with a parent born in Iran. To avoid selection bias the number of contacts each participant could suggest was limited. The project was also publicised through the local Iranian radio station. The response rate was 99% (417/428). Interviews took place in Persian in 90% and the remainder in English. The sample was similar with regard to sex and age to that of residents born in Iran in the 1991 census of the Sydney Statistical Area. The snowball sampling method generated a more educated and wealthy sample than the population of migrants from Iran to Australia.

Higgins' (2004) review referred to studies that indicate high educational and economic status of Iranian migrants. She stated that residing in the same area does not guarantee researchers contact with Iranians and that the offer of paying people for their time is unlikely to increase participation. She reported that Iranians were suspicious of strangers asking questions and that only those with strong ties to the community can be successful in research on this ethnic group. She referred to studies that reflected participants' co-operation and eagerness to participate. Factors like appeals to national or ethnic pride, choice of language and place of interview were helpful in convincing Iranians to participate. She reported finding only one study where a formal informed consent procedure was followed. In several studies a tendency among Iranian migrants to present oneself, one's family and one's community in the best possible light had been observed.

Higgins used a list of Iranian families' names, phone numbers and addresses provided by school adminis-

trators or Iranian networks to send a letter or make a telephone call to recruit Iranians. She gained consent from 101 families who agreed to participate, which was only one-third of the eligible families. She permitted the study participant to choose the language of interview and between a non-Iranian and an Iranian interviewer. Most interviews were in the family home, but the interviewer's office, participants' place of work and coffee shops were also used. Participation rate was reported to be one-third of eligible families. Higgins concluded that Iranians were not over-sensitive, sceptical or cynical, and were typical of the Iranian community in the area. The commonest reason for refusal was lack of time. She recommended that personal contacts and snowball sampling were the most effective ways of recruiting Iranian migrants.

Yavari *et al* (2005) identified Iranians in British Columbia (BC), Canada. They listed common Iranian surnames and given names from a local residential telephone book and the Screening Mammography Program of BC database. They linked this list with the BC Cancer Agency to identify Iranians who had been diagnosed with cancer. Sensitivity of this approach to detect Iranians was reported to be up to 97% for surnames.

Population-based studies on Iranian minority group: additional key points from identified papers

In three studies (30%), only females were included (Hanassab, 1991; Mahdi, 2001; Daryani *et al*, 2005). Two studies (20%) were conducted among Iranian refugees and asylum seekers (Barnes and Almasy, 2005; Gerritsen *et al*, 2006). Iranians were combined in five studies with other migrants in a collective sample (Hjern and Grindeford, 2000; Barnes and Almasy, 2005; Daryani *et al*, 2005; Holvik *et al*, 2005; Gerritsen *et al*, 2006).

Hanassab's (1991) study on Iranian women in Los Angeles, US, used a postal questionnaire. There was selection of better educated persons from higher socio-economic backgrounds. Socio-economic difference between respondents and non-respondents was also found to be a methodological limitation of the research by Wandell *et al* (2004). Hjern and Grindeford (2000) reported that Iranians had the highest level of education among migrants. They identified the higher dropout rate in the minority sample as one of their study's limitations.

Iranian migrants residing around Iowa City, US, were sent a postal questionnaire or interviewed in a study by Chaichian (1997). The response rate to postal questionnaires was 57% and for interview was 17%. Iranians who participated were highly educated

Appendix one (continued)

Table 3 Studies on methodological issues when doing research on Iranians living abroad

Author(s)/year of the publication	Title	Study design	Study place	Main methodological issue
Rissel and Khavarpour (1997)	An application of 'snowball' sampling among a small dispersed migrant population for health research.	Population based	Australia	Sampling (snowball)
Higgins (2004)	Interviewing Iranian immigrant parents and adolescents.	Population based	US	Data gathering (interviewing)
Yavari <i>et al</i> (2005)	Methodology to identify Iranian immigrants for epidemiological studies.	Population based	Canada	Recruitment method (searching Iranian surnames and given names in the databases to make contacts)

Appendix one (continued)

compared to the larger urban concentrations of Iranians.

Mahdi (2001) mailed a questionnaire with 113 questions to a number of Iranian families residing in 41 states of the US. The study target group included Iranian females randomly drawn from address lists of one cultural and two scholarly associations in the US. The response rate in this study was 21% (excluding returned questionnaires due to incorrect addresses). The sample was biased towards a more educated and professional sample. Barnes and Almasry (2005) studied refugees' perceptions of healthy behaviours. Overall participation rate for the study sample (including Iranians) was reported as 91%. They suggested not including refugees from various parts of the world in one sample without separating the data according to the similarities and differences between groups.

In a qualitative study by Momenzadeh and Posner (2003), snowball sampling was used to recruit Iranians from different socio-economic backgrounds in Australia. An English version of the questionnaire was used but interviewees were asked to respond to questions in Persian. They concluded that snowball sampling can be effectively applied with Iranian minority groups in countries like Australia to locate potential study participants. They argued that the focus group method among Iranian migrants is a useful tool for data gathering if the interviewer builds up a good relationship with participants and knows how to manage social interactions existing in relationships in Iranian culture.

Lipson (1992) sent English and Persian (translated and back-translated) versions of a standard questionnaire to 200 selected Iranians of whom only 19% responded. She suggested that this poor response rate could have resulted from distaste for written surveys, a preference for face-to-face interview or mistrust of research among Iranians in the San Francisco area.

Discussion

This is the first systematic review of recruitment methods in health research of Iranians living abroad. We found relatively few studies, but considerable heterogeneity in the methodologies used. We found 30 relevant articles, of which 13 unique studies met our inclusion criteria. One reported linking two databases of names and surnames to find Iranians (Yavari *et al*, 2005). In four articles there was missing information about important aspects of the methodology. Place of data collection (Lipson, 1992; Chaichian, 1997) application of translated versus original questionnaires (Hanassab, 1991; Chaichian, 1997; Mahdi, 2001) and language of the interviews (Hanassab, 1991; Chaichian, 1997) had often not been declared.

The wide range of participation rates from 19% to 99% in these studies probably represents differences in both recruitment and study methods. No single method of recruitment can be considered a gold standard. Similar methods in varying circumstances lead to differing results. For example, a random sampling method to recruit Iranian women resulted in participation rates of 21% in one study (Mahdi, 2001) and 79% in another (Daryani, 2005). Snowball sampling was reported to be a successful way to recruit Iranians. To avoid selection bias where marginalised people are less likely to be nominated, researchers should limit the number of contacts each participant could introduce. Snowball sampling generated a more educated and wealthy sample than the general population of Iranian migrants in a number of studies. Participation rates where snowball sampling was used to recruit Iranian males and females (Lipson, 1992) were reported to be as low as 19% and as high as 99% (Rissel and Khavarpour, 1997). In the study by Hjern and Grindeford (2000) the face-to-face interview method in the participants' home resulted in a participation rate of 68.1%, but in the study by Gerritsen *et al* (2006) the participation rate was 53%. Factors at play in these variations include time and place of study (country, city, district etc), migration status, level of education, subject of the research and measurements made in each individual study.

It is vital to understand the factors persuading or prohibiting participation by Iranians living abroad. Given the small number of studies on this ethnic minority and the diversity of methodologies, it is not possible to analyse these results statistically. However, we can conclude that Iranians have high levels of education and economic status in comparison with the other ethnic minority groups, that those participating have higher socio-economic status than those not doing so, and that useful studies are achievable for a variety of settings, countries and topics.

To increase participation by Iranians the suggestions discovered from this literature included: application of a multi-method approach to recruit Iranians; translation of the study questionnaire, brochure and consent form in the respondents' language; emphasising anonymity; choice of interviewer, language, time and place of interview; contacting of respondents by letter and in person; using an oral informed consent procedure; publicising the study through the local Iranian radio station; and giving financial incentives.

There was discussion in the literature about distaste for written surveys, strong suspicion of strangers asking questions among Iranian migrants and that only those with strong ties to the community can be successful in research on this ethnic group. One study avoided distributing a formal consent form to prevent participants being reminded of earlier confrontations with legal authorities, but in most studies no problems

Appendix one (continued)

were seen among Iranian migrants in giving consent. Overall, however, there was evidence reflecting Iranians' co-operation and eagerness to participate in research. Lack of engagement on the part of Iranians is thus unlikely to be a barrier to research; institutional barriers are likely to be far more important. Social networks and political processes in the host countries could also mediate Iranians' perceptions about ultimate objectives of health researches and their willingness to participate in such studies.

The limited data available suggest that the majority of Iranian migrants will speak the language of their adopted countries and relatively few will require translation services.

In this review we searched literature written in English or Persian language, but a sizeable number of Iranians are living in countries where other languages are used and articles or reports may be published in local languages (France, Denmark, Germany, Norway and Sweden). For this reason we probably missed some articles or reports from these countries. We limited ourselves to the websites written in English or Persian, while there are many other websites (non-English) in which one could find potentially relevant articles. In future, researchers should try to expand the search domain to include languages other than English and Persian.

There is now a considerable and growing population of Iranian migrants throughout the world; the revolution in 1979 and the eight-year war between Iraq and Iran were particular drivers for emigration to Europe, North America and Australia by mostly affluent Iranians. It is important to research the health of this migrant group and the quality and quantity of healthcare they require. An appreciable body of knowledge has been accumulated in recent years through conducting research about the health status of major ethnic groups in Europe and North America. This knowledge has helped us to achieve a better understanding about the population health needs in our societies, and accordingly to plan comprehensive public health programmes to try to address the needs of various subgroups of the population. This review shows that although clearly needed and feasible, such studies are uncommon on Iranians (none in the UK, for example). Our review shows that a wide span of topics can be studied. Heart disease, stroke, diabetes, cancer and mental illness are a few of the major health problems of Iranians overseas (and in Iran). We found no studies on diabetes, stroke and cancer, and meagre work on the other topics. In the interests of equity of healthcare, and in response to health policies and legislation promoting equality, research is mandatory. Thus, we call on the research community to take heed of the needs and opportunities identified here.

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CONTRIBUTORS

A Shaghaghi, RS Bhopal, A Sheikh and F Namdaran conceptualised and designed the study; A Shaghaghi conducted the systematic review and data extraction with helpful comments from A Sheikh; A Shaghaghi and RS Bhopal interpreted the data and wrote the manuscript. A Sheikh and F Namdaran provided key comments on the manuscript. All authors approved the final manuscript.

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CONFLICTS OF INTEREST

None.

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Appendix one (continued)

Appendix 1 Excluded studies, by title and reason for exclusion

Title of study/author(s)/publication year	Reason for exclusion
The acculturation of Iranians in the United States. Ghaffarian (1987)	Not clear residency status (permanent versus temporary)
Iranian immigrants and refugees in Norway. Kamalkhani (1999)	Not obtainable
Ethnicity and health among five Middle Eastern immigrant groups. Meleis <i>et al</i> (1992)	Data from Iranian migrants combined with other minorities
Ethnic differences in self reported health in Malmö in southern Sweden. Lindström <i>et al</i> (2001)	Data from Iranian migrants combined with other minorities
Immigration and leisure-time physical inactivity: a population-based study. Lindström and Sundquist (2001)	Data from Iranian migrants combined with other minorities
Ethnic differences in daily smoking in Malmö, Sweden. Lindström and Sundquist (2002)	Data from Iranian migrants combined with other minorities
Ethnic differences in social participation and social capital in Malmö, Sweden: a population-based study. Lindström (2005)	Data from Iranian migrants combined with other minorities
The influence of ethnicity and length of time since immigration on physical activity. Dawson <i>et al</i> (2005)	Data from Iranian migrants combined with other minorities
Sweden	
Impact of ethnicity, violence and acculturation on displaced migrants: psychological distress and psychosomatic complaints among refugees in Sweden. Sundquist <i>et al</i> (2000)	Paper published from a study already included
Ethnicity, self reported psychiatric illness, and intake of psychotropic drugs in five ethnic groups in Sweden. Bayard-Burfield <i>et al</i> (2001)	Paper published from a study already included
High use of sedatives and hypnotics in ethnic minorities in Sweden. Hjern (2001)	Paper published from a study already included
Is there equity in access to health services for ethnic minorities in Sweden? Hjern <i>et al</i> (2001)	Paper published from a study already included
Country of birth and body mass index: a national study of 2000 immigrants in Sweden. Wandell (2004)	Paper published from a study already included
Ethnicity, acculturation, and self reported health. A population based study among immigrants from Poland, Turkey, and Iran in Sweden. Wiking (2004)	Paper published from a study already included
Australia	
Mental health status of Iranian migrants in Sydney. Khavarpour and Rissel (1997)	Paper published from a study already included
Netherlands	
Health and health care utilisation among asylum seekers and refugees in The Netherlands: design of a study. Gerritsen <i>et al</i> (2004)	Paper published from a study already included
Norway	
Cardiovascular risk factors among five major immigrant groups in Oslo, Norway. Meyer and Kumar (2005)	Paper published from a study already included

Appendix one (continued)

A2. Oral presentation in the Annual Public Health Conference: 21st Century Trends - threats and opportunities for public health, 15 November 2007 at Airth Castle Hotel

A systematic review of the methods and themes of health related research on the Iranian Diaspora: massive needs and opportunities

Uncovering cardiovascular risk in the Iranian Diaspora: A systematic review to seek evidence to underpin a pilot UK survey

A3. Poster presentation in the 2nd Conference of Migrant Health in Europe, 22-24 May 2008, Malmo, Sweden

Prevalence of cardiovascular disease risk factors: comparison of the Edinburgh White population and Iranians in Tehran and Edinburgh

Appendix two

The free text and MeSH (Medical Subject Headings) indexing terms were used in the systematic review of the methods and themes of health-related research on the Iranian Diaspora:

(Iran or Iranian or Persian or Parsi\$ or Farsi\$ or Tehran\$ or Isfahan\$ or Shiraz\$ or “Fars province” or Ardabil\$ or Uromia\$ or Qazvin\$ or Tabriz\$ or Mashad\$ or Mashhad\$ or Khorasan\$ or Kerman\$ or Yazd\$ or Kermanshah\$ or Kurdistan\$ or Zahedan\$ or Lorestan\$ or “Chaharmahal and Bakhtiari” or “Kohgiluyeh va Boyer Ahmad\$” or Guilan\$ or Mazandaran\$ or Zanjan\$ or Ahwaz\$ or Khuzestan\$ or Sistan\$ Baluchestan\$ or Bandarabbas\$ or Hormozgan\$ or Bushehr\$ or Golestan\$ or Semnan\$ or Markazi\$ or Hamadan\$ or Qom\$ or Qazvin\$ or Ilam\$) AND (“ethnic groups” or ethnology or “Emigration and Immigration” or “Transients and Migrants” or “minority groups” or refugee\$ or abroad or “foreign country” or overseas).

Appendix three

A systematic review of the methods and themes of health-related research
on the Iranian Diaspora: massive needs and opportunities

DATA EXTRACTION SHEET

Study

Title:
Author(s):
Date of data gathering:
Publication date:
Setting:
Source:
Theme:

Methodology

Objective(s): ☐ Clearly stated ☐ Not clearly stated
Design: ☐ Qualitative ☐ Quantitative

Sample:

Sampling frame:
Sample size:
Sampling method:
Inclusion and exclusion criteria:
Recruitment strategy:
Participation rate:
Assessment of non-participants:

Participants:

Age range:

Gender:

Data gathering:

Method: ☐ Survey of individuals ☐ Data bases ☐ Other studies

Measurement method(s): ☐ Self report ☐ Direct observation

Tool(s):

Applied language:

Location:

Validity of assessment/measurement instrument:

Analysis

Description of analysis employed:

Statistical method:

Adjustment for confounding:

Results

Outcome measures:

Quality of reporting outcome measures ☐ Acceptable ☐ Not acceptable

Main conclusion

.....

Limitation(s)

.....

Reviewer comment(s):

.....

Appendix four

A systematic review of the methods and themes of health-related research
on the Iranian Diaspora: massive needs and opportunities

Quality criteria for assessment of internal and external validity of relevant included studies:

- ☐ Precise definition of study sample
- ☐ Clarity of data gathering technique (e.g. application of original or translated questionnaires, language used in interviews)
- ☐ Referring to the location of data collection from study participants (e.g. home, office...)
- ☐ Age, sex and state and length of residency in the host community
- ☐ Use of a representative sample of target group in the study
- ☐ Giving response rate for study.

Appendix five

The free text and MeSH (Medical Subject Headings) indexing terms were used in the risk factors of cardiovascular diseases among Iranians: a systematic review of prevalence studies:

(Iran or Iranian or Persian or Parsi\$ or Farsi\$ or Tehran\$ or Isfahan\$ or Shiraz\$ or “Fars province” or Ardabil\$ or Uromia\$ or Qazvin\$ or Tabriz\$ or Mashad\$ or Mashhad\$ or Khorasan\$ or Kerman\$ or Yazd\$ or Kermanshah\$ or Kordestan\$ or Zahedan\$ or Lorestan\$ or “Chaharmahal and Bakhtiari” or “Kohkiloieh va Boier Ahmad\$” or Gilan\$ or Mazandaran\$ or Zanzan\$ or Ahwaz\$ or Khozestan\$ or Sistan\$ or Bandarabbas\$ or Hormozgan\$ or Bushehr\$ or Golestan\$ or Semnan\$ or Markazi\$ or Hamadan\$ or Qom\$ or Qazvin\$ or Ilam\$) AND (“cardiovascular diseases” or “coronary arteriosclerosis” or “coronary disease” or arteriosclerosis or hypertension or hyperlipidemia or obese or obesity or overweight or “body mass index” or anthropomet\$ or smoking or smoker or “physical activity” or “physical inactivity” or exercise or “diabetes mellitus” or lifestyle or “Metabolic Syndrome X”).

Appendix six

Risk factors of cardiovascular diseases among Iranians: A systematic review of prevalence studies

DATA EXTRACTION SHEET

Study

Title:

Author(s):

Date of data gathering:

Publication date:

Setting:

Source:

Theme:

Methodology

Objective(s): ☐ Clearly stated ☐ Not clearly stated

Design: ☐ Retrospective ☐ Cross-sectional ☐ Longitudinal

Sample:

Sampling frame:

Sample size:

Sampling method:

Inclusion and exclusion criteria:

Recruitment strategy:

Participation rate:

Assessment of non-participants:

Participants:

Age range:

Gender: ☐ *Male (n=.....)* ☐ *Female (n=*)

Data gathering:

Method: ☐ *Survey of individuals* ☐ *Data bases* ☐ *Other studies*

Measurement method(s): ☐ *Self report* ☐ *Direct observation*

Tool(s):

Applied language:

Location:

Validity of assessment/measurement instrument:

Application of standard methods:

.....

.....

Analysis

Description of analysis employed:

Statistical method(s):

Adjustment for confounding:

Results

Main outcome measures: (Prevalence rates/confidence interval %)

	<i>Males</i>	<i>Females</i>
<i>Diabetes</i>	<i>(...../..... -)</i>	<i>(...../..... -)</i>
<i>Physical inactivity</i>	<i>(...../..... -)</i>	<i>(...../..... -)</i>

Overweight (...../..... -) (...../..... -)

Obesity (...../..... -) (...../..... -)

Dyslipidaemia

High total cholesterol (...../..... -) (...../..... -)

High triglycerides (...../..... -) (...../..... -)

High LDL-C (...../..... -) (...../..... -)

Low HDL-C (...../..... -) (...../..... -)

Smoking (...../..... -) (...../..... -)

Hypertension (...../..... -) (...../..... -)

Quality of reporting outcome measures

Prevalence rate(s) with confidence interval ☐ Yes ☐ No

Providing of adjusted prevalence rates ☐ Yes ☐ No

Main conclusion
.....

Limitation(s)
.....
.....

Reviewer comment(s):
.....
.....

Overall quality: ☐ A ☐ B ☐ C

Appendix eight

Population of Iran by age and sex: the latest population census data - 2006-07

Age group	Male		Female		Total	
	n	%	n	%	n	%
0-4	2801568	7.81	2662410	7.69	5463978	7.75
5-9	2820524	7.86	2688533	7.76	5509057	7.81
10-14	3441245	9.59	3267349	9.44	6708594	9.52
15-19	4442901	12.39	4283860	12.37	8726761	12.38
20-24	4511851	12.58	4499571	12.99	9011422	12.78
25-29	3660167	10.21	3564785	10.29	7224952	10.25
30-34	2837969	7.91	2715562	7.84	5553531	7.88
35-39	2511545	7.00	2409579	6.96	4921124	6.98
40-44	2081679	5.80	2007479	5.80	4089158	5.80
45-49	1792481	5.00	1730280	5.00	3522761	5.00
50-54	1386063	3.86	1369357	3.95	2755420	3.91
55-59	923536	2.57	964445	2.79	1887981	2.68
60-64	726449	2.03	738003	2.13	1464452	2.08
65-69	622470	1.74	575080	1.66	1197550	1.70
70-74	598231	1.67	521087	1.50	1119318	1.59
75-79	372570	1.04	321552	0.93	694122	0.98
80 and over	335113	0.93	310488	0.90	645601	0.92
Total	35866362	100.00	34629420	100.00	70495782	100.00

Source: Statistical Centre of Iran (Available from: <http://amar.sci.org.ir/>)

Appendix nine : the study questionnaire (English version)

A pilot study of the prevalence of cardiovascular disease risk factors among Iranians in Edinburgh

Please enter the date of this interview in the opposite box:

Day Month Year

1. Individual Characteristics

1.1 Can I just check, your age is?

(Range: 18-120)

1.2 Can I just check, your sex is?

Male ☐ Female ☐

1.3 Can I just check, what is your date of birth?

(Enter Day of month in numbers, Name of month in words (first three letters), Year in numbers) (You can write your birth date according to the either Christine or Iranian calendar)

The Christian Calendar: Day Month Year

The Iranian Calendar: Day Month Year

1.4 To which of the following groups do you consider you belong?

1 Iranian ☐

2 Mixed British-Iranian ☐

3 Other ☐ 4 How would you describe the racial or ethnic group to which you belong? ☐

1.5 In which country were you born?

1 Iran ☐ 2 in the city of ☐

3 UK ☐ 4 in the city of ☐

5 Other country ☐ 6 in the city of ☐

1.6 How long have you been living in the UK?

Months and years

1.7 How long have you been living outside of Iran?

Months and years

1.8 Where is the country of birth of your parents?

- 1 Mother ☐
- 2 Father..... ☐
- 3 I don't know my mother's country of birth ☐
- 4 I don't know my father's country of birth ☐

2. Cardiovascular disease and use of services

2.1 I am now going to ask you some questions mainly about symptoms of the chest.

Have you ever had any pain or discomfort in your chest?

- 1 Yes ☐
- 2 No ☐ *If no go to the question 2.10*

2.2 Do you get it when you walk uphill or hurry?

- 1 Yes ☐
- 2 No ☐ *If no go to the question 2.4*
- 3 Never walks uphill or hurries ☐
- 4 (Cannot walk) ☐

2.3 Does this happen:

- 1 On most occasions ☐
- 2 Sometimes/Occasionally ☐

2.4 Do you get it when you walk at an ordinary pace on the level?

- 1 Yes ☐
- 2 No ☐ *If no go to the question 2.10*
- 3 Never walk at an ordinary pace on the level ☐
- 4 (Cannot walk) ☐

2.5 Does this happen:

- 1 On most occasions ☐
- 2 Sometimes/Occasionally ☐

2.6 What do you do if you get it while you are walking? Do you stop, slow down or carry on? IF RESPONDENT UNSURE, PROBE: What do you do on most occasions?

- 1 Stop ☐

2 Slow down ☐

3 Carry on ☐

2.7 If you stand still does the pain go away or not?

IF RESPONDENT UNSURE, PROBE: What happens to the pain on most occasions?

1 Pain goes away ☐

2 Pain doesn't go away ☐

2.8 How soon does the pain go away? Does it go in:

1 ...10 minutes or less ☐

2 or more than 10 minutes ☐

2.9 Will you show me where you get this pain or discomfort?

INTERVIEWER: USE SHOW CARD A TO HELP CODE POSITION OF PAIN

OR DISCOMFORT. CODE ALL THAT APPLY. PROBE: Where else?

1 Sternum (upper or middle) ☐

2 Sternum lower ☐

3 Left anterior chest ☐

4 Left arm ☐

5 Right anterior chest ☐

6 Right arm ☐

7 (Somewhere else) ☐

2.10 Have you ever had a severe pain across the front of your chest lasting for half an hour or more?

1 Yes ☐

2 No ☐ *If no go to the question 2.13*

2.11 Did you see a doctor because of this pain?

1 Yes ☐

2 No ☐

2.12 What did the doctor say it was? (CODE ALL THAT APPLY)

1 Angina ☐

2 Heart attacks ☐

3 Did not say ☐

4 Other ☐

INTERVIEWER READ OUT: You have already talked to me about your health, and now I would like to go on and talk in more detail about some particular conditions. (They may include some of the things you have already mentioned.)

2.13 Do you now have, or have you ever had, high blood pressure (sometimes called hypertension)?

1 Yes ☐

2 No ☐ *If no go to the question 2.19*

2.14 Are you currently taking any medicines, tablets or pills for high blood pressure?

1 Yes ☐

2 No ☐

(If male go to the question 2.18)

2.15 Can I just check, were you pregnant when you were told that you had high blood pressure?

1 Yes ☐

2 No ☐ *If male enter code 9*

2.16 Have you ever had high blood pressure apart from when you were pregnant?

1 Yes ☐

2 No ☐ *If no go to the question 2.20 (If male enter code 9)*

2.17 Apart from when you were pregnant, approximately how old were you when you were first told by a (doctor/nurse) that you had high blood pressure?

(ENTER AGE IN YEARS) (Range: 0..110)

2.18 What other treatment or advice are you currently receiving because of your high blood pressure? (PROBE: What else? CODE ALL THAT APPLY)

1 Blood pressure monitored by GP/nurse ☐

2 Advice or treatment to lose weight ☐

3 Blood tests ☐

4 Change diet ☐

5 Stop smoking ☐

- 6 Reduce stress ☐
- 7 Other ☐ 8 ☐
- 9 I don't receive other treatment or advice ☐

2. 19 Have you ever had angina?

- 1 Yes ☐
- 2 No ☐ *If no go to the question 2.22*

2.20 You said that you had Angina. Were you told by a doctor that you had angina?

- 1 Yes ☐
- 2 No ☐

2.21 Approximately how old were you when you were first told by a doctor that you had angina?

Years old (TYPE IN AGE IN YEARS. Range: 0..110)

2.22 Have you ever had a heart attack (including myocardial infarction or coronary thrombosis)?

- 1 Yes ☐
- 2 No ☐ *If no go to the question 2.24*

2.23 Approximately how old were you when you were first told by a doctor that you had a heart attack (including myocardial infarction and coronary thrombosis)?

Years old (TYPE IN AGE IN YEARS) (Range: 0..110)

2.24 Have you ever had a stroke?

- 1 Yes ☐
- 2 No ☐ *If no go to the question 2.26*

2.25 Approximately how old were you when you were first told by a doctor that you had a stroke?

(TYPE IN AGE IN YEARS) (Range: 0..110)

2.26 Are you currently taking any medicines, tablets or pills because of your (heart condition or stroke)?

- 1 Yes ☐
- 2 No ☐

2. 27 Have you ever undergone any surgery or operation because of your heart condition?

1 Yes ☐

2 No ☐

2.28 Can I just check, are you currently on a waiting list for any such surgery or operation?

1 Yes ☐

2 No ☐

2.29 What (*other*) treatment or advice are you currently receiving because of your (*heart condition or stroke*)? (PROBE: What else? CODE ALL THAT APPLY)

1 Special diet ☐

2 Regular check-up with GP/hospital/clinic ☐

3 Other ☐ 4 PLEASE SPECIFY..... ☐

5 I don't receive other treatment or advice ☐

2.30 Do you now have, or have you ever had diabetes?

1 Yes ☐

2 No ☐ *If no go to the question 3.1*

(If male go to the question 2.34)

2.31 Can I just check, were you pregnant when you were told that you had diabetes?

1 Yes ☐

2 No ☐ (If male enter code 9)

2.32 Have you ever had diabetes apart from when you were pregnant?

1 Yes ☐

2 No ☐ *If no go to the question 2.34 (If male enter code 9)*

2.33 Apart from when you were pregnant, (approximately) how old were you when you were first told by a doctor that you had diabetes?

(ENTER AGE IN YEARS) (Range: 0..110)

2.34 Do you currently inject insulin for diabetes?

1 Yes ☐

2 No ☐

2.35 Are you currently taking any medicines, tablets or pills (*other than insulin injections*) for diabetes?

1 Yes ☐

2 No ☐

2.36 What (*other non pharmacologic*) treatment or advice are you currently receiving for diabetes?

1 Dietary restriction ☐

2 Regular check-up with GP/hospital/clinic ☐

3 Other ☐ 4 PLEASE SPECIFY ☐

5 I don't receive other treatment or advice ☐

3. Adult physical activity module

3.1 I'd like to ask you about some of the things you have done in the past four weeks that involve physical activity, this could be at work (*school/college*) or in your free time. (Can I just check) were you in paid employment or self-employed in the past four weeks?

1 Yes ☐

2 No ☐ *If no go to the question 3.3*

3.2 Thinking about your job in general would you say that you are ...READ OUT..

1 ...very physically active ☐

2 ...fairly physically active ☐

3 ...not very physically active ☐

4 ...or, not at all physically active in your job ☐

3.3 I'd like you to think about the physical activities you have done in the last few weeks (*when you were not doing your paid job.*) Have you done any housework in the past four weeks, which is from (*date four weeks ago*) up to yesterday?

1 Yes ☐

2 No ☐

SHOW CARD B

3.4 Have you done any housework listed on this card?

1 Yes ☐

2 No ☐

SHOW CARD C

3.5 Some kinds of housework are heavier than others. This card gives some examples of heavy housework. It does not include everything, these are just examples. Was any of the housework you did in the last four weeks this kind of heavy housework? ☐☐

1 Yes ☐ **On how many days have you done it?** (Range: 1..28)

2 No ☐

SHOW CARD D

3.6 Have you done any gardening, DIY or building work listed on this card?

1 Yes ☐

2 No ☐

SHOW CARD E

3.7 Have you done any gardening, DIY or building work from this other card, or any similar heavy manual work?

1 Yes ☐

2 No ☐ *If no go to the question 3.10*

3.8 During the past 4 weeks on how many days have you done this kind of heavy manual gardening or DIY? (Range: 1..28)

☐☐ Day(s)

3.9 On the days you did heavy manual gardening or DIY, how long did you usually spend?

☐☐ . ☐☐ (RECORD HOURS AND MINUTES SPENT. ENTER 0 IF LESS THAN 1 HOUR)

3.10 I'd like you to think about all the walking you have done in the past 4 weeks either locally or away from here. Please include any country walks, walking to and from work and any other walks that you have done. In the past four weeks, that is since (date four weeks ago), have you done a continuous walk that lasted at least 5 minutes?

1 Yes ☐

2 No ☐ *If no go to the question 3.13*

3 Can't walk at all ☐ *If can't walk go to the question 3.13*

3.11 In the past four weeks, have you done a continuous walk that lasted at least 15 minutes? (That is since (date four weeks ago))

1 Yes ☐ **On how many days?** ☐☐ (Range: 1..28)

2 No ☐

3.12 Which of the following best describes your usual walking pace:

1 ...a slow pace ☐

2 ...a steady average pace ☐

3 ...a fairly brisk pace ☐

4 ...or, a fast pace – at least 4 mph ☐

5 (none of these) ☐

SHOW CARD F

3.13 Can you tell me if you have done any activities on this card during the last 4 weeks that is since (date four weeks ago)? Include teaching, coaching, training and practice sessions.

1 Yes ☐

2 No ☐ *If no go to the question 3.13*

3.14 Which have you done in the last four weeks? PROBE: Any others? CODE

ALL THAT APPLY.

1 Swimming ☐

2 Cycling ☐

3 Workout at a gym/Exercise bike/ Weight training ☐

4 Aerobics/Keep fit/Gymnastics/ Dance for fitness ☐

5 Any other type of dancing ☐

6 Running/jogging ☐

7 Football/rugby ☐

8 Badminton/tennis ☐

9 Squash ☐

10 Exercises (e.g. press-ups, sit ups) ☐

11 Others ☐

3.15 Can you tell me on how many separate days did you do (*name of activity*) for at least 15 minutes a time during the past four weeks, that is since (*date four weeks ago*)?

☐ ☐ (IF ONLY DONE FOR LESS THAN 15 MINUTES ENTER 0). (Range: 0..28)

3.16 During the past four weeks, was the effort of (*name of activity*) usually enough to make you out of breath or sweaty?

1 Yes ☐

2 No ☐

3.17 When you're at work are you mainly sitting down, standing up or walking about?

(CODE ONE ONLY)

1 Sitting down ☐

2 Standing up ☐

3 Walking about ☐

4 Equal time spent doing 2 or more of these ☐

3.18 Does your work involve you moving between floors?

1 Yes ☐

2 No ☐

3.19 Do you mainly take the lift or climb the stairs?

1 Lift ☐

2 Stairs ☐

3 Lift up/stairs down ☐

3.20 Do you do any (other) climbing in the course of your work (ladders, scaffolding etc.)?

1 Yes ☐

2 No ☐

3.21 So overall, would you say that in terms of physical effort your work is...(READ OUT...)

1 ... very demanding ☐

2 fairly demanding ☐

3 or not very demanding ☐

4. Eating habits module

4.1 What type of spread do you usually use on bread, sandwiches, toast, potatoes or vegetables?

- 1 Butter or margarine ☐
- 2 Low fat or reduced fat spread, or half-fat butter ☐
- 3 Spread not on coding list ☐

SPONTANEOUS:

- 4 Does not have usual type ☐
- 5 Does not use fat spread ☐
- 6 What other kind of spread do you usually eat? ☐

SHOW CARD G

4.2 When you have fried foods at home, what kind of fat or oil are the foods usually cooked in? Please look at SHOW CARD G and tell me which type of fat or oil is used most often?

- 1 Solid cooking fat (including butter, dripping lard, ghee, white cap, cookeen) ☐
- 2 Half-fat butter ☐
- 3 Polyunsaturated, sunflower or olive margarine ☐
- 4 Other hard or soft margarine or dairy blend, (including Flora, Clover, Willow) ☐
- 5 Low fat spreads ☐
- 6 Vegetable oil (including olive, sunflower, soya, corn, peanut, rapeseed) ☐
- 7 Some other kind of fat/oil ☐
- 8 What is the other fat or oil your food is usually fried in? ☐
- 9 (Does not eat fried food) ☐

4.3 What kind of milk do you usually use for drinks, in tea or coffee and on cereals?

Is it

READ OUT...

- 1 whole milk, ☐
- 2 semi-skimmed (INCL DRIED SEMI-SKIMMED), ☐
- 3 skimmed (INCL DRIED SKIMMED, BOOTS DRIED POWDER, CO-OP POWDER), ☐

4 or, some other kind of milk? Text: Maximum 15 characters..... ☐

5 Evaporated/Condensed milk ☐

6 Soya/Veg-based milk ☐

SPONTANEOUS:

7 Does not have usual type ☐

8 Does not drink milk ☐

4.4 Do you usually have sugar in your tea or coffee?

1 Yes, usually has sugar (DO NOT INCLUDE SWEETENERS) ☐

2 NO ☐

3 I generally use sweetener instead of sugar ☐

4 Does not drink tea ☐

5 Does not drink coffee ☐

4.5 At the table do you ...READ OUT...

1 usually add salt to your food without tasting it first, ☐

2 taste the food, but then generally add salt, ☐

3 taste the food, but only occasionally add salt, ☐

4 rarely, or never, add salt at the table? ☐

SHOW CARD H

4.6 Can you tell me how often on average you eat fresh fruits by choosing an answer from this card?

1 6 or more times a day ☐

2 4 or 5 times a day ☐

3 2 or 3 times a day ☐

4 Once a day ☐

5 5 or 6 times a week ☐

6 2 to 4 times a week ☐

7 Once a week ☐

8 1 to 3 times per month ☐

9 Less often or never ☐

SHOW CARD H

4.7 How often do you eat fried food, including fried fish, chips, cooked breakfast, samosas?

- 1 6 or more times a day ☐
- 2 4 or 5 times a day ☐
- 3 2 or 3 times a day ☐
- 4 Once a day ☐
- 5 5 or 6 times a week ☐
- 6 2 to 4 times a week ☐
- 7 Once a week ☐
- 8 1 to 3 times per month ☐
- 9 Less often or never ☐

SHOW CARD H

SHOW CARD H

4.8 How often do you eat raw vegetables, or salad?

INCLUDE TOMATOES. DO NOT INCLUDE SALAD IN A SANDWICH

- 1 6 or more times a day ☐
- 2 4 or 5 times a day ☐
- 3 2 or 3 times a day ☐
- 4 Once a day ☐
- 5 5 or 6 times a week ☐
- 6 2 to 4 times a week ☐
- 7 Once a week ☐
- 8 1 to 3 times per month ☐
- 9 Less often or never ☐

SHOW CARD H

4.9 How often do you eat MEAT, SUCH AS beef, lamb ETC?

INCLUDE BEEFBURGERS, SAUSAGE, BACON, MEAT PIES, MINCE AND PROCESSED MEAT. (DO NOT INCLUDE POULTRY)

- 1 6 or more times a day ☐
- 2 4 or 5 times a day ☐

- 3 2 or 3 times a day ☐
- 4 Once a day ☐
- 5 5 or 6 times a week ☐
- 6 2 to 4 times a week ☐
- 7 Once a week ☐
- 8 1 to 3 times per month ☐
- 9 Less often or never ☐

SHOW CARD H

4.10 How often do you eat poultry, such as chicken or turkey?

INCLUDE CHICKEN OR TURKEY IN BURGERS, SAUSAGES, MEAT PIES,
MINCE AND PROCESSED MEAT

- 1 6 or more times a day ☐
- 2 4 or 5 times a day ☐
- 3 2 or 3 times a day ☐
- 4 Once a day ☐
- 5 5 or 6 times a week ☐
- 6 2 to 4 times a week ☐
- 7 Once a week ☐
- 8 1 to 3 times per month ☐
- 9 Less often or never ☐

SHOW CARD H

4.11 How often do you eat white fish, such as cod, haddock, whiting, sole or plaice?

INCLUDE FRESH, FROZEN OR CANNED

- 1 6 or more times a day ☐
- 2 4 or 5 times a day ☐
- 3 2 or 3 times a day ☐
- 4 Once a day ☐
- 5 5 or 6 times a week ☐
- 6 2 to 4 times a week ☐
- 7 Once a week ☐

- 8 1 to 3 times per month ☐
- 9 Less often or never ☐

SHOW CARD H

4.12 How often do you eat other types of fish, such as herring, tuna, mackerel, salmon or kippers? (INCLUDE FRESH, FROZEN OR CANNED)

- 1 6 or more times a day ☐
- 2 4 or 5 times a day ☐
- 3 2 or 3 times a day ☐
- 4 Once a day ☐
- 5 5 or 6 times a week ☐
- 6 2 to 4 times a week ☐
- 7 Once a week ☐
- 8 1 to 3 times per month ☐
- 9 Less often or never ☐

SHOW CARD H

4.13 How often do you eat chocolates, crisps or biscuits, including savoury biscuits such as cream crackers?

- 1 6 or more times a day ☐
- 2 4 or 5 times a day ☐
- 3 2 or 3 times a day ☐
- 4 Once a day ☐
- 5 5 or 6 times a week ☐
- 6 2 to 4 times a week ☐
- 7 Once a week ☐
- 8 1 to 3 times per month ☐
- 9 Less often or never ☐

SHOW CARD H

4.14 How often do you eat sweets, cakes, pastries or ice-cream?

- 1 6 or more times a day ☐
- 2 4 or 5 times a day ☐

- 3 2 or 3 times a day ☐
- 4 Once a day ☐
- 5 5 or 6 times a week ☐
- 6 2 to 4 times a week ☐
- 7 Once a week ☐
- 8 1 to 3 times per month ☐
- 9 Less often or never ☐

SHOW CARD H

4.15 How often do you drink soft drinks, not including diet or low-calorie drinks?

INCLUDE SQUASHES AND FIZZY DRINKS. INCLUDE CANS, BOTTLES AND MIXERS.

DO NOT INCLUDE FRESH FRUIT JUICE

- 1 6 or more times a day ☐
- 2 4 or 5 times a day ☐
- 3 2 or 3 times a day ☐
- 4 Once a day ☐
- 5 5 or 6 times a week ☐
- 6 2 to 4 times a week ☐
- 7 Once a week ☐
- 8 1 to 3 times per month ☐
- 9 Less often or never ☐

5. Smoking module

5.1 May I just check, have you ever smoked a cigarette, cigar or pipe?

- 1 Yes ☐
- 2 No ☐ *If no go to the question 5.13*

5.2 Do you smoke cigarettes or cigar at all nowadays?

- 1 Yes ☐
- 2 No ☐ *If no got to the question 5.13*

5.3 About how many cigarettes or cigar a day do you usually smoke on weekdays?

INTERVIEWER: IF LESS THAN ONE A DAY, ENTER 0. IF RANGE GIVEN AND CAN'T ESTIMATE,

ENTER MID POINT. IF RESPONDENT SMOKES ROLL UPS AND CANNOT GIVE NUMBER OF CIGARETTES, CODE 97.

☐☐ Range: 0..97

5.4 And about how many cigarettes or cigar a day do you usually smoke at weekends?

INTERVIEWER: IF RANGE GIVEN AND CAN'T ESTIMATE, ENTER MID POINT. IF RESPONDENT

SMOKES ROLL UPS AND CANNOT GIVE NUMBER OF CIGARETTES, CODE 97.

☐☐ (Range: 0..97)

5.5 Do you smoke a pipe at all nowadays?

1 Yes ☐

2 No ☐ *If no got to the question 5.8*

5.6 How much tobacco do you usually smoke on weekdays?

CODE HERE WHETHER AMOUNT IS TO BE CODED IN GRAMS OR OUNCES. ENTER THE AMOUNT NEXT.

1 Grams ☐ 2 ENTER AMOUNT IN GRAMS (Range: 0..100) ☐☐

3 Ounces ☐ 4 Computed: estimated tobacco consumption in ounces (Range: 1..97) ☐☐

(For analysis purposes ounces or grams of tobacco are converted to number of cigarettes and stored in the variable DlySmoke.)

5.7 How much tobacco do you usually smoke on weekends?

CODE HERE WHETHER AMOUNT IS TO BE CODED IN GRAMS OR OUNCES. ENTER THE AMOUNT AT THE NEXT QUESTION.

1 Grams ☐ ENTER AMOUNT IN GRAMS (Range: 0..100) ☐☐

2 Ounces ☐ Computed: estimated tobacco consumption in ounces (Range: 1..97) ☐☐

(For analysis purposes ounces or grams of tobacco are converted to number of cigarettes and stored in the variable WkndSmoke.)

5.8 And for approximately how many years did you smoke regularly?

INTERVIEWER: IF LESS THAN ONE YEAR, CODE 0.

☐☐ Range: 0..97

5.9 How old were you when you started to smoke cigarettes regularly?

INTERVIEWER: IF Never smoked regularly CODE 97

☐☐ Range: 1..97

(IF (Sex = Male) OR (Female aged >49 years go to the question 5.13)

5.10 Can I check, are you pregnant now or have you been pregnant in the last twelve months?

1 Yes ☐

2 No ☐ *If no go to the question 5.17*

5.11 Have you smoked at all since you've known you've been pregnant?

IF YES, PROBE: All the time or just some of the time?

1 Yes, all the time ☐

2 Yes, some of the time ☐

3 No, not at all ☐

5.12 Did you stop smoking specifically because of your pregnancy, or for some other reason?

1 Because of pregnancy ☐

2 For some other reason ☐

5.13 May I just check, have you ever smoked a Hubble bubble?

1 Yes ☐

2 No ☐ *If no go to the question 5.17*

5.14 Do you smoke Hubble bubble at all nowadays?

1 Yes ☐

2 No ☐ *If no go to the question 5.17*

5.15 Do you smoke Hubble bubble regularly that is at least one Hubble bubble a month, or do you smoke it only occasionally?

1 Smoke at least one Hubble bubble a month ☐

2 Smoke it only occasionally ☐ *If occasionally go to the question 5.22*

5.16 About how many Hubble bubble do you usually smoke in a week?

ENTER NUMBER SMOKED A WEEK. IF CAN ONLY GIVE RANGE, TAKE MID-POINT. IF LESS THAN ONE A WEEK CODE 0.

Range: 0... 997

IF not Smoking now OR have not ever smoked THEN:

SHOW CARD J

5.17 Are you regularly exposed to other people's tobacco smoke in any of these places? PROBE: Where else?

CODE ALL THAT APPLY

- | | |
|---------------------------|--------------------------|
| 1 At own home | <input type="checkbox"/> |
| 2 At work | <input type="checkbox"/> |
| 3 In other people's homes | <input type="checkbox"/> |
| 4 On public transport | <input type="checkbox"/> |
| 5 In pubs | <input type="checkbox"/> |
| 6 In other public places | <input type="checkbox"/> |
| 7 No, none of these | <input type="checkbox"/> |

6. Alcohol drinking module

IF (Age of Respondent is 20 years or over)

6.1 I am now going to ask you a few questions about what you drink - that is if you drink. Do you ever drink alcohol nowadays, including drinks you brew or make at home?

- 1 Yes ☐ *If yes go to the question 6.4*
2 No ☐

6.2 Could I just check, does that mean you never have an alcoholic drink nowadays, or do you have an alcoholic drink very occasionally, perhaps for medicinal purposes or on special occasions like Christmas and New Year?

- 1 Very occasionally ☐ *Go to the question 6.5*
2 Never ☐

6.3 Did you stop drinking because of a particular health condition that you had at the time? INTERVIEWER: IF RESPONDENT SAYS PREGNANCY, CODE YES.

- 1 Yes ☐
2 No ☐ *Go to the question 6.6*

(If drinks alcohols nowadays otherwise go to the question 6.7)

6.4 How much alcoholic drink have you usually drunk on any one day?

INTERVIEWER: CODE MEASURES THAT YOU ARE GOING TO USE.

- 1 Half pints ☐
- 2 Singles ☐
- 3 Glasses ☐
- 4 Bottles ☐
- 5 Other Maximum 12 characters ☐

SHOW CARD K

6.5 How often have you had an *alcoholic drink* in the last 12 months?

- 1 Almost every day ☐
- 2 Five or six days a week ☐
- 3 Three or four days a week ☐
- 4 Once or twice a week ☐
- 5 Once or twice a month ☐
- 6 Once every couple of months ☐
- 7 Once or twice a year ☐
- 8 Not at all in the last 12 months ☐

6.6 Do you have reservations about answering questions about alcohol drinking behaviors?

- 1. Yes ☐
- 2. No ☐

7. Economic Activity module

SHOW CARD L

7.1 Which of these descriptions applies to what you were doing last week, that is in the seven days ending (date last Sunday)?

(CODE FIRST TO APPLY)

- 1. Going to school or college full-time (including on vacation) ☐
- 2. In paid employment or self-employment (or away temporarily) ☐
- 3. Waiting to take up paid work already obtained ☐ *If so go to the question 7.2*
- 4. Looking for work ☐

5. Intending to look for work but prevented by temporary sickness or injury
(CHECK 28 DAYS OR LESS) ☐
6. Permanently unable to work because of long-term sickness or disability (USE
ONLY FOR MEN **AGED 16-64 OR WOMEN AGED 16-59**) ☐
7. Retired (FOR WOMEN CHECK AGE STOPPED WORK AND USE THIS
CODE ONLY IF STOPPED WHEN 50 OR OVER) ☐
8. Looking after the home or family ☐
9. Doing something else (SPECIFY) 10 ☐

If in employment ask otherwise go to the question 7.3

**7.2 I'd like to ask you some details about the job you were doing last week (your
most recent job/the main job you had/the job you are waiting to take up). What is
(was/will be) the name or title of the job?**

(IF 2+ JOBS, ASK ABOUT MAIN JOB)

Text: Maximum 50 characters ☐

7.3 How many members in your family are economically dependent on you?

☐ ☐ Members

8. Education module

**8.1 At what age did you finish your continuous full-time education at school or
college?**

- | | |
|------------------------|--------------------------|
| 1 Not yet finished | <input type="checkbox"/> |
| 2 Never went to school | <input type="checkbox"/> |
| 3 14 or under | <input type="checkbox"/> |
| 4 15 | <input type="checkbox"/> |
| 5 16 | <input type="checkbox"/> |
| 6 17 | <input type="checkbox"/> |
| 7 18 | <input type="checkbox"/> |
| 8 19 | <input type="checkbox"/> |
| 9 22-24 | <input type="checkbox"/> |
| 10 24-28 | <input type="checkbox"/> |

11 28 and above ☐

8.2 Please tell me whether you have any of the qualifications listed below. Look down the list and tell me the first one you come to that you have got. (CODE FIRST TO APPLY.)

- 1 PhD (doctorate degree) ☐
2 MSc or MA (master degree) ☐
3 BSc (bachelor degree) ☐
4 College degree (in Iran) ☐
5 SCE Higher/CSYS (Certificate of Sixth Year Studies)/ A-Level or diploma in Iran ☐
6 Lower grades than SCE/CSYS/A-Level/Iranian diploma ☐
7 Other academic qualification ☐ 8 Specify ☐
.....

9. Family history module

9.1 Is your natural mother still alive?

- 1 Yes ☐
2 No ☐ *If no go to the question 9.4*

9.2 How old is your natural mother?

(Range: 1..120)

9.3 Does your mother has or ever had from any of the following conditions?

- 1 High blood pressure (sometimes called hypertension) ☐
2 Angina ☐
3 Heart attack (including myocardial infarction and coronary thrombosis) ☐
4 Stroke ☐
5 Other heart trouble (incl. heart murmur, damaged heart valves, tachycardia or rapid heart) ☐
6 Diabetes ☐
7 None of the above conditions ☐

If your mother still alive go to the question 9.6

9.4 Did your mother die from any of the following conditions?

1. Yes at age from:

a High blood pressure (sometimes called hypertension) ☐

b Angina ☐

c Heart attack (including myocardial infarction and coronary thrombosis) ☐

d Stroke ☐

e Other heart trouble (incl. heart murmur, damaged heart valves, tachycardia or rapid

heart) ☐

f Diabetes ☐

2 None of the above conditions ☐

9.5 How old was your natural mother when she died?

(Range: 1..120)

9.6 Is your natural father still alive?

1 Yes ☐

2 No ☐ *If no go to the question 9.9*

9.7 How old is your natural father?

(Range: 10..120)

9.8 Does your father has or ever had from any of the following conditions?

1 High blood pressure (sometimes called hypertension) ☐

2 Angina ☐

3 Heart attack (including myocardial infarction and coronary thrombosis) ☐

4 Stroke ☐

5 Other heart trouble (incl. heart murmur, damaged heart valves, tachycardia or rapid

heart) ☐

6 Diabetes ☐

7 None of the above conditions ☐

If your father still alive go to the question 9.11

9.9 Did your father die from any of the following conditions?

1. Yes at age from:

a High blood pressure (sometimes called hypertension) ☐

b Angina ☐

c Heart attack (including myocardial infarction and coronary thrombosis) ☐

d Stroke ☐

e Other heart trouble (incl. heart murmur, damaged heart valves, tachycardia or rapid

heart) ☐

f Diabetes ☐

2 None of the above conditions ☐

9.10 How old was your natural father when he died?

(Range: 10..120)

9.11 Have you or ever had a natural sibling?

1. Yes ☐☐ sibling(s) (Range: 1-15)

2. No ☐ *If no go to the question 10.1*

9.12 Does/do your sibling(s) has/have or ever had from any of the following conditions?

1 High blood pressure (sometimes called hypertension) ☐ in of them

2 Angina ☐ in of them

3 Heart attack (including myocardial infarction and coronary thrombosis) ☐ in

of

them

4 Stroke ☐ in of them

5 Other heart trouble (incl. heart murmur, damaged heart valves, tachycardia or rapid

heart) ☐ in of them

6 Diabetes ☐ in of them

7 None of the above conditions ☐

9.13 Did one of your sibling(s) die from any of the following conditions?

1 of them from high blood pressure (sometimes called hypertension)

- 2 ☐☐ of them from angina
- 3 ☐☐ of them heart attack (including myocardial infarction and coronary thrombosis)
- 4 ☐☐ of them from stroke
- 5 ☐☐ of them from other heart trouble (incl. heart murmur, damaged heart valves, tachycardia or rapid heart)
- 6 ☐☐ of them from diabetes
- 7 None of the above conditions ☐

10. General Household module

Now, I'd like to get some general information about your household.

10.1 Does your household own or rent this accommodation?

(PROBE FOR DETAILS.)

- | | |
|----------------------------------|--------------------------|
| 1 Owns with mortgage/loan | <input type="checkbox"/> |
| 2 Owns outright | <input type="checkbox"/> |
| 3 Rents from council | <input type="checkbox"/> |
| 4 Rents - privately, unfurnished | <input type="checkbox"/> |
| 5 Rents - privately, furnished | <input type="checkbox"/> |
| 6 Rents from employer | <input type="checkbox"/> |
| 7 Rents - other with payment | <input type="checkbox"/> |
| 8 Rent free | <input type="checkbox"/> |

10.2 Have you a car or van normally available for use by you or any members of your household?

- 1 Yes ☐
- 2 No ☐

10.3 May I check with you the post code of your home address?

1. Yes ☐ 2. It is ☐
3. No ☐

11. Measurements module

PREAMBLE: I would now like to measure your height/weight/waist and hip. There is interest in how people's weight/waist/hip, given their height, is associated with their health.

11.1 Height cm (Range: 120-240)

11.2 Height measurement result:

1 Height measured ☐

2 Height refused ☐

3 Reason:

☐

.....

4 Height attempted, not obtained ☐

5 Reason:

☐

.....

6 Height not attempted ☐

7 Reason:

☐

.....

INTERVIEWER CODE ONE ONLY

11.3 During height measurement was any problem experienced?

1 No problems experienced reliable height measurement obtained ☐

Problems experienced - measurement likely to be:

2 Reliable ☐

3 Unreliable ☐

11.4 WHAT CAUSED THE HEIGHT MEASUREMENT TO BE UNRELIABLE?

1 Hairstyle or wig ☐

2 Turban or other religious headgear ☐

3 Respondent stooped ☐

4 Respondent wore shoes ☐

5 Other, please specify ☐

6

☐

.....

7 Difficulty standing

11.5 Weight . Kg (Range: 45.0-244.0 kg)

11.6 Weight measurement result:

1 Weight obtained (subject on own) ☐

2 Weight refused	<input type="checkbox"/>	3 Reason:	<input type="checkbox"/>
.....			
4 Weight attempted, not obtained	<input type="checkbox"/>	5 Reason:	<input type="checkbox"/>
.....			
6 Weight not attempted	<input type="checkbox"/>	7 Reason:	<input type="checkbox"/>
.....			

INTERVIEWER CODE ONE ONLY.

11.7 During weight measurement was any problem experienced?

1 No problems experienced, reliable weight measurement obtained ☐

Problems experienced - measurement likely to be:

2 Reliable ☐

3 Unreliable ☐

11.8 Waist: First measurement . cm Second measurement . cm

11.9 Waist measurement result:

1 Waist obtained	<input type="checkbox"/>	
2 Waist refused	<input type="checkbox"/>	3 Reason: <input type="checkbox"/>
.....		
4 Waist attempted, not obtained	<input type="checkbox"/>	5 Reason: <input type="checkbox"/>
.....		
6 Waist not attempted	<input type="checkbox"/>	7 Reason: <input type="checkbox"/>
.....		

INTERVIEWER CODE ONE ONLY.

11.10 During waist measurement was any problem experienced?

1 No problems experienced, reliable waist measurement obtained ☐

Problems experienced - measurement likely to be:

2 Reliable ☐

3 Unreliable ☐

11.11 Hip: First measurement cm Second measurement cm

11.12 Hip measurement result:

- 1 Hip obtained ☐
- 2 Hip refused ☐ 3 Reason: ☐
-
- 4 Hip attempted, not obtained ☐ 5 Reason: ☐
-
- 6 Hip not attempted ☐ 7 Reason: ☐
-

INTERVIEWER CODE ONE ONLY.

11.13 During hip measurement was any problem experienced?

- 1 No problems experienced, reliable hip measurement obtained ☐
- Problems experienced - measurement likely to be:
- 2 Reliable ☐
- 3 Unreliable ☐

11.14 Blood pressure

First measurement: MmHg (Systolic)
 MmHg (Diastolic)

Second measurement: MmHg (Systolic)
 MmHg (Diastolic)

11.15 Blood pressure measurement result:

- 1 BP obtained ☐
- 2 BP refused ☐ 3 Reason: ☐
-
- 4 BP attempted, not obtained ☐ 5 Reason: ☐
-
- 6 BP not attempted ☐ 7 Reason: ☐

INTERVIEWER CODE ONE ONLY.

11.16 During blood pressure measurement was any problem experienced?

1 No problems experienced, reliable blood pressure measurement obtained ☐

Problems experienced - measurement likely to be:

2 Reliable ☐

3 Unreliable ☐

11.17 Blood sample:

1 TC . Mmol/l

2 HDL . Mmol/l

3 LDL . Mmol/l

4 Glucose . Mmol/l

11.18 Blood sample taking result:

1 Blood sample obtained ☐

2 Blood sample taking refused ☐

3 Reason:

☐

.....

4 Blood sample taking attempted, not obtained ☐

5 Reason:

☐

.....

6 Blood sample taking not attempted ☐

7 Reason:

☐

11.19 During blood sample taking was any problem experienced?

1 No problems experienced, reliable blood sample obtained ☐

Problems experienced – sample likely to be:

2 Reliable ☐

3 Unreliable ☐

12. Study setting and participants' concerns module

12.1 In which language would you prefer the questionnaire or interview in future similar studies?

1. Persian ☐

2. English ☐

3. Azeri Turkish ☐

4. Other ☐

12.2 What do you think would be successful ways of reaching Iranians in Edinburgh for studies of this kind?

..... ☐

12.3 Would you willing to allow your name and contact details to go on a list of all Iranians in Scotland for a future health study of this kind?

1. Yes ☐

2. No ☐ 3 Why? ☐

12.4 Are you willing to share your family and friends' contact details so they can be invited to participate in this study?

1 Yes ☐ 2 Why? ☐

.....

3 No ☐ 4 Why? ☐

12.5 Does the religion of a study researcher or interviewer affect your participation in such health studies?

1. Yes ☐ 2 Why? ☐

3. No ☐

12.6 Does the ethnic characteristic of a study researcher or interviewer affect your participation in such health studies?

1. Yes ☐ 2 Why? ☐

3. No ☐

12.7 Does the sex of a study researcher or interviewer affect your participation in such health studies?

1. Yes ☐ 2 Why? ☐

3. No ☐

12.8 Does the age of a study researcher or interviewer affect your participation in such health studies?

1. Yes ☐ 2 Why? ☐

3. No ☐

12.9 Are there any other aspects related to the study researcher or interviewer which could affect your participation in such health studies?

1. Yes ☐ Clarify (If more than one aspect explain all):
2. ☐
3. ☐
4. ☐
5. ☐
6. No ☐

12.10 What is your preference in relation to the gender of practitioner who examines or assesses you physically?

- 1 I prefer to be examined by a practitioner of the same gender in all kinds of examinations including hip and waist measurements ☐
- 2 I prefer to be examined by practitioner of opposite gender in all kinds of examinations ☐
- 3 I only prefer to be examined by practitioner of same gender in examinations of my private areas ☐
- 4 I have no preferences about gender of practitioner ☐

12. 11 Which method of questioning might increase your participation in similar health studies?

1. Face to face interview ☐
2. Self completion paper questionnaire ☐
3. Telephone interview ☐
4. On line internet interview ☐
5. Self completion electronic questionnaire ☐

12.12 What other factors would increase your participation with studies of this kind?

- 1 ☐
- 2 ☐
- 3 ☐

- 4 ☐
- 5 ☐

If blood sample not obtained go to the question 12.14

12.13 Would you agree for your blood sample be stored for further analysis in the future for other CVD risk factors?

- 1 Yes ☐ 2 Why? ☐
- 3 No ☐ 4 Why? ☐

12.14 How did you feel about the time questions took in this interview?

- 1 Too long/taking long time to answer ☐
- 2 About right ☐
- 3 Too short ☐

12.15 Did you find the questions in this interview easy to understand?

1. Yes ☐
2. No ☐ If no which questions or part of questions were not easy to understand?

- 3 ☐
4. ☐
5. ☐
6. ☐
7. ☐

12.16 Did you find any questions in this interview too sensitive to you?

1. Yes ☐
2. No ☐ 3 Which questions or part of questions were too sensitive to you? ... ☐
-
4. ☐
5. ☐
6. ☐
7. ☐

12.17 What religion, religious denomination or body do you belong to?

- 1 Muslim ☐

- 2 Zoroastrian ☐
- 3 Christian ☐
- 4 Jew ☐
- 5 Baha'i ☐
- 6 None ☐
- 7 Others ☐ 8 Clarify ☐

12.18 Do you think Iranians living in Edinburgh would be willing to let their religion or faith be known to an interviewer in future health studies?

1. Yes ☐
2. No ☐ 3 Specify reason ☐

12.19 Did you find the question about religion in this study sensitive?

1. Yes ☐
2. No ☐

12.20 Have you any suggestion to improve participation of Iranians in future health studies?

1. Yes ☐ 2 Clarify ☐

.....

3. No ☐

12.21 INTERVIEWER: Record how the respondent answered questions:

1. Face to face interview ☐
2. Postal questionnaire ☐
3. Electronic questionnaire (through email) ☐
4. Telephone interview ☐

12.22 INTERVIEWER: Record where this interview and measurements took place:

- 1 In the study site ☐
- 2 Any other place ☐ 3 Specify ☐

12.23 INTERVIEWER: Record whether questions in the questionnaire were fully answered?

1. Fully completed ☐

- 2. Partially completed ☐
- 3. Not completed ☐ 4 Reason ☐

12.24 INTERVIEWER: Record whether the questionnaire was completed:

- 1. Independently ☐
- 2. With interviewer assistance ☐
- 3. With other family member assistance ☐
- 4. By interviewer ☐

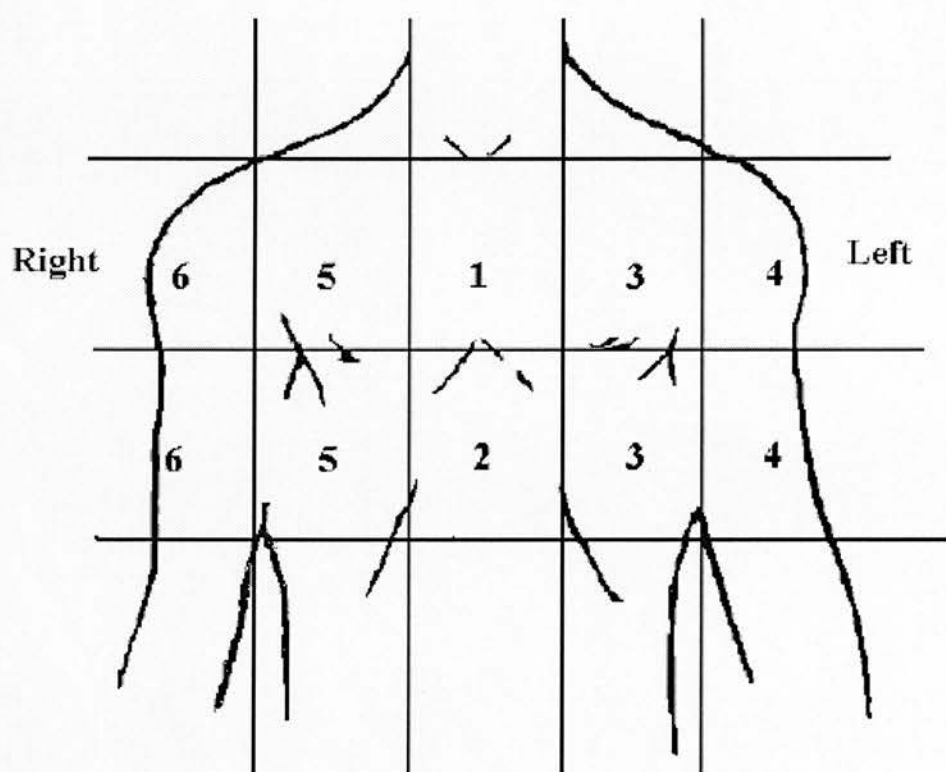
12.25 INTERVIEWER: In which language the interview was taken place?

- 1. Completely Persian ☐
- 2. Completely Azeri Turkish ☐
- 3. Completely English ☐
- 4. Mostly Persian with some English explanations ☐
- 5. Mostly Azeri Turkish with some English explanations ☐
- 6. Mostly Azeri Turkish with some Persian explanations ☐
- 7. Mostly English with some Persian explanations ☐
- 8. Mostly Persian with some Azeri Turkish explanations ☐
- 9. Mostly English with some Azeri Turkish explanations ☐

12.26 INTERVIEWER: Record has this participant given his/her consent to:

- 1 Give blood sample for analysis about mentioned CVD risk factors ☐
- 2 Allow his/her GP to be informed about participation in this study ☐
- 3 Allow his/her GP to receive a copy of the analysis of cardiovascular risk status ☐

CARD A



SHS 98 P 1731

CARD B

HOUSEWORK

1 Hoovering

2 Dusting

3 Ironing

4 General tidying

5 Washing floors and paint work

SHS 98 P 1731

CARD C

HEAVY HOUSEWORK

- 1 Moving heavy furniture
- 2 Spring cleaning
- 3 Walking with heavy shopping (for more than 5 minutes)
- 4 Cleaning windows
- 5 Scrubbing floors with a scrubbing brush

SHS 98 P 1731

CARD D

GARDENING, DIY AND BUILDING WORK

- 1 Hoeing, weeding, pruning
- 2 Mowing with a power mower
- 3 Planting flowers/seeds
- 4 Decorating
- 5 Minor household repairs
- 6 Car washing and polishing
- 7 Car repairs and maintenance

SHS 98 P 1731

CARD E

HEAVY MANUAL WORK

- 1 Digging, clearing rough ground
- 2 Building in stone/bricklaying
- 3 Mowing large areas with a hand mower
- 4 Felling trees, chopping wood
- 5 Mixing/laying concrete
- 6 Moving heavy loads
- 7 Refitting a kitchen or bathroom

CARD F

- 1 Swimming.
- 2 Cycling.
- 3 Workout at a gym / Exercise bike / Weight training.
- 4 Aerobics / Keep fit / Gymnastics / Dance for fitness.
- 5 Any other type of dancing.
- 6 Running / Jogging.
- 7 Football / Rugby.
- 8 Badminton / Tennis.
- 9 Squash.
- 10 Exercises (e.g. press-ups, sit-ups)

Please also include teaching, coaching and training/practice sessions.

CARD G

1 Solid cooking fat ((including butter, dripping, lard, ghee, white cap, cookeen)

2 Half-fat butter

3 Polyunsaturated, sunflower or olive margarine

4 Other hard or soft margarine or dairy blend (including Flora, Clover, Willow)

5 Low-fat spreads

6 Vegetable oil (including olive, sunflower, soya, corn, peanut, rapeseed)

7 Some other kind of fat / oil

CARD H

- 1 6 or more times a day
- 2 4 or 5 times a day
- 3 2 or 3 times a day
- 4 Once a day
- 5 5 or 6 times a week
- 6 2 to 4 times a week
- 7 Once a week
- 8 1 to 3 times per month
- 9 Less often or never

CARD I

1. Heart trouble/problem
2. High blood pressure
3. Cancer
4. Bronchitis
5. Cough
6. Shortness of breath
7. Other respiratory problems (incl. asthma)
8. Cold/flu/virus
9. Pregnancy
10. Ulcer or other gastrointestinal problem
11. Diabetes
12. Any other condition (PLEASE SAY WHAT)

CARD J

1. At own home
2. At work
3. In other people's homes
4. On public transport
5. In pubs
6. In other public places

CARD K

- 1 Almost every day
- 2 Five or six days a week
- 3 Three or four days a week
- 4 Once or twice a week
- 5 Once or twice a month
- 6 Once every couple of months
- 7 Once or twice a year
- 8 Not at all in the last twelve months

CARD L

1. Going to school or college full-time (including on vacation)
2. In paid employment or self-employed (or away temporarily)
3. Waiting to take up paid work already obtained
4. Looking for work
5. Intending to look for work but prevented by temporary sickness
6. Permanently unable to work because of long term sickness or disability
7. Retired
8. Looking after the home or family
9. Doing something else (PLEASE SPECIFY)

Appendix Ten

Lothian NHS Research Ethics Committee approval

Lothian NHS Board

Deaconess House
148 Pleasance
Edinburgh
EH8 9RS
Telephone 0131 536 9000
Fax 0131 536 9009
www.nhsllothian.scot.nhs.uk

NHS

Lothian

Deaconess House
148 Pleasance
Edinburgh
EH8 9RS

Telephone: 0131 536 9022
Facsimile: 0131 536 9346

18 May 2006

Mr Abdolreza Shaghaghi
PhD student
University of Edinburgh
Public Health Sciences, Department of Community Health Sciences
The University of Edinburgh, Medical School,
Teviot place, Edinburgh, UK
EH8 9 AG

Dear Mr Shaghaghi

Full title of study: A pilot study of the prevalence of established cardiovascular disease risk factors among Iranians in Edinburgh
REC reference number: 05/S1101/49

Thank you for your letter of 09 May 2006, responding to the Committee's request for further information on the above research and submitting revised documentation.

The further information was considered by the Chair on behalf of LREC 1.

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised.

Conditions of approval

The favourable opinion is given provided that you comply with the conditions set out in the attached document. You are advised to study the conditions carefully.

Approved documents

The final list of documents reviewed and approved by the Committee is as follows:

Document	Version	Date
Application	2	06 February 2006
Investigator CV	shaghaghi	
Investigator CV	bhopal	
Protocol	05-01	29 November 2005
Compensation Arrangements		15 April 2005
Questionnaire: Updated	4	28 April 2006
GP/Consultant Information Sheets	06-01	06 January 2006

INVESTOR IN PEOPLE



Participant Information Sheet: PIS	3	09 May 2006
Participant Consent Form: Consent Form 1	May	09 May 2006
Participant Consent Form: Consent Form 2 for possible future research	May	09 May 2006
Response to Request for Further Information	Further Response	09 May 2006
Response to Request for Further Information		08 March 2006
Other	5-1 - info leaflet	29 November 2005

Research governance approval

The study should not commence at any NHS site until the local Principal Investigator has obtained final research governance approval from the R&D Department for the relevant NHS care organisation.

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees (July 2001) and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

05/S1101/49

Please quote this number on all correspondence

With the Committee's best wishes for the success of this project

Yours sincerely

Chair

Email: joyce.clearie@lhb.scot.nhs.uk

Enclosures:

Standard approval conditions [SL-AC1 for CTIMPs, SL-AC2 for other studies]
Site approval form

Copy to:

The University of Edinburgh
College of Medicine and Veterinary Medicine
The University of Edinburgh
The Chancellor's Building, 49 Little France Crescent, Edinburgh
[R&D Department for NHS care organisation at lead site]

SF1 list of approved sites

Appendix 11

NHS Research and Development Office (R&D) approval

University Hospitals Division

Queen's Medical Research Institute
47 Little France Crescent, Edinburgh, EH16 4TJ

HAC/GO/approval/2b,3,3b

23 May 2006

Mr Abdolrza Shaghaghi
PhD Student
Public Health Sciences
University of Edinburgh
Medical School
Teviot Place
Edinburgh

Dear Mr Shaghaghi

MREC No:	N/A
CRF No:	E06341
LREC No:	05/S1101/49
R&D ID No:	2006/R/CAR/08
Title of Research	<i>A pilot study of the prevalence of established cardiovascular disease risk factors among Iranians in Edinburgh</i>
Protocol No/Acronym:	N/A

The above project has undergone an assessment of risk to the Division and review of resource and financial implications. I am satisfied that all the necessary arrangements have been set in place and that all Departments contributing to the project have been informed.

As this project involves healthy volunteers, I note that the University of Edinburgh will act as Sponsor of the study.

Use of Tissue or Samples

- ♦ The study involves the use of patient tissue or samples. You must be familiar with NHS Lothian's Tissue Policy and abide by its conditions and also with all regulations in place at the time. Approval is subject to the prevailing legal requirements.
- ♦ Approval for the use of tissue is restricted to the protocol associated with this application, but may include additional collaborators within University of Edinburgh. Collaborators who are not named in the original protocol require to be notified to local REC.
- ♦ If material is to be transferred to academic collaborators outwith University of Edinburgh or to any commercial entity then a material transfer agreement must be obtained from the R&D Office and signed by all relevant parties prior to transfer of the material. Such collaborations must be fully discussed with the R&D Office.

NHS

Lothian

**RESEARCH &
DEVELOPMENT
OFFICE**

Tel: 0131 242 3330
Fax: 0131 242 3343
Email
R&DOffice@luht.scot.nhs.uk

Director:
Dr Heather A Cubie
FRCPath

R&D Project Manager:
Rachel Smith
PhD

**Commercial Research
Manager:**
Douglas Young
PhD MBA

**Research Governance
Co-ordinator:**
Mrs Susan Shepherd
MSc

Accountant:
Ms Sheevaun McIntyre
BAcc

Assistant Accountant:
Mr Neil McLean

Trial Support Officer:
Mrs Dorothy Aitken
BA

PA/Office Manager:
Mrs Glynis Omond

Administrator St John's
Mrs Anne Addison

- ◆ I note that additional samples will be taken for the study and that this will be done with the patient's explicit consent.

On behalf of the Chief executive and Medical Director, I am happy to grant management approval from NHS Lothian - University Hospitals Division to allow the project to commence, subject to the approval of the appropriate Research Ethics Committee(s) having also been obtained. You should note that any substantial amendments must be notified to the relevant Research Ethics Committee and to R&D Management with approval being granted from both before the amendments are made.

Please note that under Section A, Q35, NHS Lothian provides indemnity for negligence for NHS and Honorary clinical staff for research associated with their clinical duties. It is not empowered to provide non-negligent indemnity cover for patients. Lothian University Hospitals Division does not provide indemnity against negligence for healthy volunteer studies. This is the personal responsibility of both NHS and honorary employees and is usually arranged with a medical defence organisation or through the University of Edinburgh.

This letter of approval is your assurance that the Division is satisfied with your study. As Chief Investigator or local Principal Investigator, you should be fully committed to your responsibilities within the Research Governance Framework for Health and Community Care, an extract of which is attached to this letter.

Yours sincerely

Dr Heather A Cubie
R&D Director

enc	Research Governance Certificate	<input checked="" type="checkbox"/> (to be signed and returned)
	NRR authorisation	<input checked="" type="checkbox"/> (to be signed and returned)
	Tissue Policy (if applicable)	<input checked="" type="checkbox"/>
	MTA (if applicable)	<input type="checkbox"/> (to be signed and returned)
cc	<i>Administrators, Research Ethics Committee</i> <i>Fiona McArdle, Clinical Research facility, RIE</i> <i>Professor Raj Bhopal, Public Health Sciences, Medical School, Teviot Place</i>	

NHS Lothian - University Hospitals Division

Research & Development Office, Royal Infirmary of Edinburgh

Project ID: 2006/R/CAR/08

Project Title: A pilot study of the prevalence of established cardiovascular disease risk factors among Iranians in Edinburgh.

REC Ref: 05/S1101/49

Principal Investigator: Mr Abdolreza Shaghagi

RESEARCH GOVERNANCE FRAMEWORK (RGF) FOR HEALTH & COMMUNITY CARE

The framework is of direct relevance to all those who host, conduct, participate in, fund and manage health and community care research. The framework applies to all managers and staff, in all professional groups, irrespective of seniority.

Research Governance

- Sets standards
- Defines mechanisms to deliver standards
- Requires monitoring and assessment
- Improves research quality & safeguards the public

Responsibilities and Accountabilities of Principal Investigator (PI)

The PI must take responsibility for the conduct of the research and is accountable for this to their employer, and, through them, to the sponsor of the research and to the care organisation(s) within which the research takes place or through which participants, their organs, tissue or data are accessed. The PI must have adequate qualifications and experience to take on these responsibilities.

In brief, they must ensure that:

- The dignity, rights, safety and well being of participants are given priority at all times by the research team.
- Ethical and management approval is obtained **BEFORE** study commences.
- Care professionals involved with patients are informed of study and its protocols.
- Study complies with all legal and ethical requirements e.g. data protection, informed consent & with RGF.
- Each member of the research team is qualified to discharge their role in study and that students are adequately supervised.
- When a study involves participants under the care of a doctor, nurse or other worker for the condition in which the study relates, those care professionals are informed that their patients or users are being invited to participate and agree to retain overall responsibility for their care.
- If any information relevant to the care of a patient arises through research, the patient's care professional must be notified. Unless, the patient or the relevant research ethics committee request otherwise.
- Reporting all adverse events, including adverse drug reactions through the appropriate systems.
- Controlled trials are registered.
- Research follows an approved protocol - any proposed changes or amendments to protocol are notified to the appropriate research ethics committee, sponsor and research host.
- Findings open to critical review through accepted scientific and professional channels and disseminated promptly.
- Key role in detecting and preventing scientific misconduct, by adopting role of guarantor on published outputs.
- Arrangements in place for financial management of the study and any Intellectual Property arising from it.
- All data are stored appropriately at end of study and are available for audit.
- Procedures are in place to ensure quality data are collected, processed, analysed, stored and archived
- Progress reports are sent to sponsors promptly and are of an acceptable standard

For further information and access to the complete Research Governance document visit: -
<http://www.show.scot.nhs.uk/cso>

Date: 27/05/2006 1

Signature: _____

LOTHIAN HEALTH BOARD

RESEARCH & DEVELOPMENT OFFICE

POLICY ON USE OF PATIENT TISSUE AND SAMPLES

- i. 'Tissue and samples' includes biopsy samples, bodily fluids, autopsy specimens/organs, resection material and anything derived from such (e.g. nucleic acids).
- ii. 'Non-diagnostic use' includes, for example, all biomedical research, product and process development, and any use of tissue by a third party, excluding teaching and diagnostic testing at another centre.
- iii. Lothian Health Board ("the Board") is the Guardian of all tissue and samples taken from patients of the Board, including those taken from the recently deceased, unless the Crown takes possession (in the case of forensic tissue).
- iv. The Board is uniquely placed to supply tissue and samples that have the potential to advance biomedical knowledge and understanding. However, the over-arching principal to the use of patients' tissue and samples for non-diagnostic purposes is that such use must not compromise the diagnosis or subsequent care of the patients involved. Therefore all relevant aspects of governance must be adhered to.
- v. The Board, through the R&D Office, requires to be notified and give its approval of all research involving patients, patient samples, access to records and names of past and present NHS patients and the use of NHS premises or facilities.
- vi. In addition to the approval indicated in point v. above, all research involving patients, patient samples, access to records, names of past and present NHS patients must have received a favourable ethical opinion from a relevant research ethics committee.
- vii. If tissue or samples are to be removed for diagnostic purposes, and a portion of this tissue or sample is to be retained for non-diagnostic use (including research), all sub-sampling should be conducted following a protocol that meets the requirements of the person with delegated authority from the Guardian¹.
- viii. The non-diagnostic use of excess diagnostic specimens can only proceed with prior discussion and approval from the person with appropriate authority delegated by the Guardian¹.
- ix. Any additional tissue or samples taken from patients for non-diagnostic purposes must be taken with the patient's explicit consent. The need to take additional tissue and samples must be made clear in the Patient Information Sheet.
- x. Non-diagnostic use of any tissue or sample removed from a patient which is not required for diagnosis can only proceed provided the appropriate permissions are obtained.
- xi. Material already taken for therapeutic purposes which then becomes unsuitable or superfluous may be used for research, provided the appropriate consent has been obtained at the time of collection.
- xii. Any further proposed investigations using tissue and samples stored since the fulfilment of their original purpose, require permission from the Guardian with appropriate ethical approval, subject to prevailing legal requirements. Where it is not practicable to contact patients to seek consent, the

¹ Person with authority delegated by the Guardian: Prof David Harrison (Pathology), deputy Dr William Wallace (Pathology)

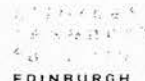
proposed use may still be possible provided the Guardian gives its approval and appropriate ethical approval is obtained.

- xiii. The Patient Information Sheet (PIS), which accompanies the patient consent form, must be full and complete, including being specific about where the sample goes, where the sample ends up and the timing of its disposal. When patient tissue or samples are shared with third parties, this information must be made explicit in the PIS.
- xiv. Where a patient sample is to be used in a test which is still undergoing development or validation, which may have diagnostic or therapeutic significance, whether this test is conducted in a laboratory within NHS Lothian or that of third party, the patient should be fully aware of the research nature of the test if they are to be told the result.
- xv. Any tissue or samples, which remain unused at the end of a study or the collaboration, remain under the Guardianship of the Board.
- xvi. The Board is moving towards a single managed system for the storage and use of tissue and samples stored within NHS Lothian, irrespective of where the tissue or sample originated. All tissue and samples will be assimilated into this collection, to ensure it is stored in a secure, safe and supervised environment, preferably on more than one site (to insure against losses). The collection will have an appropriate Management Committee to ensure that the bank is well managed and governed: this committee will be accountable to the Guardian. Tissues or samples cannot be released from this collection to any third party² without the permission of the Management Committee, the Board and with appropriate ethical approval consistent with prevailing legal requirements.
- xvii. In terms of the NHS (Scotland) Act 1978 (as amended), the Scottish Ministers delegate authority to treat patients to NHS Boards. Accordingly doctors and other professional staff within hospitals are only entitled to have patient contact by virtue of their status as Board employees. Therefore it is the Board as their employer (whether honorary employer or not) who would be liable if a claim arose as a result of such treatment. The Central Legal Office therefore advises that it is vital that the Board is a party to any Agreement whereby the staff member is to carry out clinical research on patients.
- xviii. Any tissue or sample transferred from the Board to an academic or commercial organisation (outwith the University of Edinburgh) for non-diagnostic purposes (including commercial or academic research) must be transferred under an appropriate Material Transfer Agreement (MTA). Any tissue or samples transferred under such agreements will remain under the Guardianship of the Board.
- xix. The sale of tissue or samples is not permitted but where there is a commercial research partner, the Board will recover the administrative and other processing costs. An appropriate Material Transfer Agreement must be in place and supporting clinical, radiological, demographic and laboratory information archived in a manner that protects patient confidentiality. For prospective samples, it is essential that the research is not prejudicial to clinical care and that there are no pressures to obtain a specific number of samples.
- xx. The 2005 MRC Operational and Ethical Guidelines – Human Tissue and Biological Samples for use in Research provide well balanced guidelines which the Board will adopt as far as possible and until further guidance for Scotland is available.

² The University of Edinburgh is excluded from this provision provided the activity has an identified clinical investigator.

Appendix 12

Study site approval (Wellcome Trust Clinical Research Facility at Edinburgh's Western General Hospital)



Dr Abdolreza Shaghghi
Public Health Sciences
Division of Community Health Sciences
The University of Edinburgh
Medical School
Teviot Place
Edinburgh

13th April 2006

OUTCOME: PROJECT FEASIBILITY REVIEW – NEW Application (Full)

Protocol Title: A pilot study of the prevalence of cardiovascular disease risk factors among Iranians in Edinburgh.

Ethics No: 05/S1101/49
R&D No: not yet known
CRF No: E06341

Date of OMC Approval: 5th April 2006

Dear Dr Shaghghi,

I am pleased to inform you that the CRF Operational Management Committee (OMC) has approved your study to be carried out at the Wellcome Trust Clinical Research Facility.

Approval is granted on the following basis:

(1) This approval is subject to evidence of both Ethical approval and Trust R&D Management approval. This study will not start until we have received specific and explicit approval documentation for all aspects of your protocol.

(2) Please be advised that it remains the responsibility of the Investigator to ensure that the appropriate Ethics and R&D management approvals are in place.

(3) From the feasibility review undertaken we intend to raise a charge of £137.50 for clinical supplies and general support costs.

(4) The use of the CRF resources as agreed at feasibility review –

Duration of study: 12 months

Number of subjects: 75

Number of visits per subject: 1

Scheduling plan: 5 – 15 per week

Staff: A nurse is required to assist with this study for venepuncture and some measurements.

Space: Access is requested to a clinic room for study interviews. The treatment room/additional clinic room would also be required for venepuncture and measurements of skin-fold thickness.

If there are any significant resource variations during the study these may be subject to further application / amendment approval.

Clinical Research Facility

Clinical Research Facility

(5) The use of the CRF equipment, if requested. Please note – if you intend to use your own equipment this should be discussed with Gordon Hill and is subject to CRF Policy (available on request).

(6) All staff working in the CRF will be required to attend a brief induction prior to commencing work in the facility.

(7) Studies undertaken in the CRF require all participating researchers and their assistants to adhere to CRF Policy as well as appropriate Standard Operating Procedures (SOPs). Policy documents are available on request.

(8) All users are required to inform the Clinical Research Facility of publications and/or presentations arising from research studies involving CRF resources. Investigators are required to acknowledge the CRF in all relevant publications.

(9) Continued support is dependant on satisfactory study progression and availability of CRF resources against competing service demands.

(10) The Principal Investigator retains responsibility for the safe and ethical conduct of their study and for reporting any adverse events. All source material remains the responsibility of the Principal Investigator.

With best wishes for a successful study.

Yours sincerely,

CRF Administration Manager

Copy: Gordon Hill, WTCRF Nurse Manager

Appendix 13

The University of Edinburgh's Health and Safety Department approval



COLLEGE of
MEDICINE and VETERINARY MEDICINE OFFICE

16 March 2006

Room E1.06
The Queen's Medical Research Institute
University of Edinburgh
47 Little France Crescent
Edinburgh EH16 4TJ
Scotland UK

Tel. (0131) 242 9262
Fax (0131) 242 9301
Email marise.brown@ed.ac.uk

Mr Abdolreza Shaghaghi
University of Edinburgh
Public Health Sciences
Department of Community Health Sciences
Teviot Place
Edinburgh EH8 9AG

Dear Mr Shaghaghi

05/S1101/49 – A pilot study of the prevalence of cardiovascular risk factors among Iranians.

Thank you for forwarding copies of the protocol and ethics application relating to the above study.

I can now confirm that this research will come within the liability insurance cover held by the University.

I would be grateful if you could send me a copy of the LREC approval when you receive this.

Yours sincerely

Marise Brown
College of Medicine and Veterinary Medicine Office
The University of Edinburgh

Appendix 14

Scottish Criminal Record Office approval

STRICTLY PRIVATE AND CONFIDENTIAL

D sclosure

MR ABDOLREZA SHAGHAGHI

312753

Applicant Personal Details

Surname: SHAGHAGHI

Forename(s): ABDOLREZA

Date of Birth:

Convictions

Date

Court

Offence

NONE

Reprimands, Warnings and Cautions

Date

Court

Offence

NONE

Other Relevant Information

NONE

END OF DISCLOSURE

ENHANCED DISCLOSURE

APPLICANT COPY

Disclosure Number: 120100033168150

Date of Issue: 03/02/2006

page 01 of 01

A copy of this Disclosure has also been sent to:

MIS STEFANIA PANKOWIAK

UNIVERSITY OF EDINBURGH COLLEGE OF MEDIC

COLLEGE OF MEDICINE AND VETERINARY MEDIC

47 LITTLE FRANCE CRESCENT

EDINBURGH

EH164TJ

Appointment Details

Position Applied For: CHILDCARE RESEARCHER

Name of Employer: UNIVERSITY OF EDINBURGH


Countersignature Details


Registered Body: UNIVERSITY OF EDINBURGH COLLEG


Registered Person: MIS STEFANIA PANKOWIAK

Disposal

Disposal

 SCOTTISH CRIMINAL RECORD OFFICE

 SCOTTISH EXECUTIVE

 BT

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Appendix 15

Version 05-01, Date 29/11/2005



A pilot study of the prevalence of established cardiovascular disease (CVD) risk factors among Iranians living in the UK (Edinburgh)

Information for study participants



Why cardiovascular disease is important?

Cardiovascular disease is accounted as a major cause of death and morbidity throughout the world and ranked as a first cause of death in many countries. There are some distinct risk factors, which may contribute to CVD and its consequences. For instance, stroke and coronary heart disease (CHD) that killed nearly 12.7 million of people globally at 2002 is caused mainly by disease or disruption of the blood vessels supplying the heart muscle. The phenomenon may result from either narrowing or blockage of blood vessel for which

unhealthy diet, physical inactivity and tobacco smoke are serious risk factors.

In many developed countries prevalence of the contributing risk factors, morbidity and death rates are decreased in recent decades.

Is prevalence of CVD different among minorities living in a foreign country?

In developed countries the prevalence of CVD risk factors among migrants who preserved their homeland (in the developing world) style of living is contrastive in comparison with both population in the country of origin and general population.

The study of subjects separated from their environment and cultural background and adapted to a new socio-cultural environment may provide a strong tool for assessing of environmental and genetic influences on occurrence of the disease.

What we know about prevalence of CVD among Iranian migrants living abroad?

There has been an increasing pattern of migration from Iran to countries all over the world in last three decades. According to the statistics given by official resources 135,383 of Iranians migrated to USA, Canada, Germany, Netherlands, UK, Sweden and Australia during 1996-2000. However, the actual number of migrants having Iranian origin seems to be at least 2.5 million around the globe with more concentration in USA, Canada and the UK. In contrast to this substantial figure the number of population-based health studies on Iranian minority group living abroad is rare.

There are few studies investigating the prevalence of CVD and its risk factors in Iran and contrary to increasing migration rate from Iran to other countries fewer still among Iranians living abroad. The degree to which the frequency of CVD risk factors among Iranian ethnic groups living abroad is similar to that seen among the general population and the population of origin could be a fundamental base for clarification of cultural, environmental and genetic influences on the prevalence of this disease and its predisposing factors amongst Iranians.

What is the objective of this study?

A proposal set out to conduct a population-based study about the prevalence of established CVD risk factors in Iranian minority group of the UK (Edinburgh). This study is planned within the University of Edinburgh and is under full supervision of highly qualified researchers based in the school of medicine. Main researcher is a PhD student (A. Reza Shaghagh) who selected this subject as his field of interest. The findings will be informative in determining whether Iranians are in greater risk of CVD to receive CVD targeted primary health cares in comparison with the UK general white population. Consequently results of this study will be influential in decision making about efficient allocation of NHS resources for control of CVD risk factors among Iranians as well as other minorities in the UK.

Contact:

Office: xxxxx

Mobile: xxxxx

Email: xxxxx@ed.ac.uk

Appendix 16

The standard Operating Procedure (SOP) followed to measure body weight of the study participants: Wellcome Trust Clinical Research Facility (WTCRF) document.

Document Number: CRF/2005/N&C/V1/B008

Title: Performing a body weight measure (using SECA 797 and SECA 761 scales)

Version: 1

Author: Jo-Anne Robertson

Effective from:	18 Nov 2005
Valid to:	17 Nov 2008
Superseded Version Number & Date (if applicable)	N/A

Revision History

Comments: New Standard Operating Procedure

Written by: Jo-Anne Robertson

Date: 17 Nov 2005

Next review due: 01 Jul 2006

Signature(s):

Comments:

Reviewed by:

Next review due:

Signature(s):

1.0 Purpose

This Standard Operating Procedure (SOP) describes the correct procedure for performing body weight using the SECA 797 and the SECA 761 weighing scales.

2.0 Scope

This SOP applies to the measurement of body weight within the Clinical Research Facility (CRF)


3.0 Responsibilities

It is the responsibility of the CRF staff performing a body weight to have read this SOP and be familiar with this equipment.

4.0 Procedure

Before body weight is measured on the scales the volunteer should remove outdoor clothing, their shoes and any heavy items in pockets.

4.1 To measure body weight using the SECA 797 scales:

4.1.1 Press the start key 


4.1.2 **SECA, 8.8.8.8** and **0.0** will appear consecutively on the display

4.1.3 The scales are automatically zeroed and ready to use

4.1.4 If required the weight display can be changed, see section 4.2

4.1.5 Subject should then stand on scales and be instructed to keep still

4.1.6 The result appears on the digital display

4.1.7 If a load of 160 kilograms or 350 pounds (the maximum threshold) is placed on the scales  appears on the display

4.1.8 To switch off the scales press the start key again


4.1.9 The scales automatically switch off after 3 minutes

4.2 To switch the weight display:

The weight display can be switched between kilograms (kgs) and pounds (lbs)

4.2.1 Switch on the scales using the start key

4.2.2 Weight will be displayed on the last setting selected

4.2.3 To switch press the  key

4.2.4 The kgs or lbs display lights up and the switch can now be made


4.3 Maintenance

4.3.1 Surfaces can be cleaned using a domestic cleaning agent or commercially available disinfectant. Always follow instructions for use when cleaning

4.3.2 No abrasive or acid cleaners, white spirit, benzene or similar should be used as this can damage the surfaces

4.3.3 Calibration should be undertaken annually by an approved company

4.4 Changing Batteries

4.4.1 When  or *batt* appears on the display, batteries should be changed

4.4.2 Turn over scales so that the base is easily accessible

4.4.3 Push the battery compartment closure towards *batterie* and hold open the cover

4.4.4 Take out the holder and the batteries

4.4.5 Remove the used batteries and insert new ones

4.4.6 Place the holder and batteries in the battery compartment

4.4.7 Close the cover

4.4.8 Turn the scale back the right way

5.0 To measure body weight using the SECA 761 scales:

5.1.1. Subject instructed to stand on scales

5.1.2. Subject to stay completely still when on the scales

5.1.3 Reading can be read in either kilograms (kgs) or pounds (lbs). (lbs on the outer circle, kgs on the inner circle)

6.0 Related documents

- Seca 797 & 761 Instructions For Use

7.0 References

- Seca 797 & 761 Instructions For Use

8.0 Approval and sign off –

Author:

Name: Jo-Anne Robertson

Position: Research Nurse

Signature:

Date: 17 Nov 2005

Approved by (either Core Manager or CRM):

Name: Gordon Hill

Position: Nurse Manager

Signature:

Date: 18 Nov 2005

Name: Geraldine Cummings

Position: Charge Nurse

Signature:

Date: 18 Nov 2005

Appendix 17

The standard Operating Procedure (SOP) followed to measure body height of the study participants: Wellcome Trust Clinical Research Facility (WTCRF) document.

Document Number: CRF/2005/N&C/V1/B006

Title: Measurement of Standing Height

Version 1

Author: Barbara McLaren

Effective from:	18 Nov 05
Valid to:	17 Nov 08
Superseded Version Number & Date (if applicable)	N/A

Revision History

Comments: New Standard Operating Procedure

Written by Barbara McLaren

Date: 07 Nov 2005

Next review due: 01 Jul 2006

Signature(s):

Comments: Added numbering in section 4. Change of text in item 4.2.

Reviewed by: Gerry Cummings and Gordon Hill

Next review due: 01 Jul 2006

Signature(s)

3.0 Purpose

The purpose of this Standard Operating Procedure (SOP) is to ensure accurate, repeatable measurements.

4.0 Scope

This SOP applies to all staff undertaking the measurement of standing height within the Clinical Research Facility (CRF)

3.0 Responsibilities

It is the responsibility of all staff performing the measurement to familiarise themselves with this SOP and any equipment used.

4.0 Procedure

4.1 The subjects should be asked to remove their shoes

4.2 The subject should be able to stand unsupported with their legs straight, their heels, head and shoulder blades should be touching the wall or vertical scale.

4.3 Ensure that the subject is standing with their feet parallel to each other, toes pointing forward and the soles flat on the floor or as per diagram on the measuring base.

4.4 The subject should stand as tall as possible looking straight ahead.

4.5 The horizontal measure should be brought down to rest on the top of their head.

4.6 Read the measurement on the vertical scale to the nearest millimetre.

4.7 Record the measurement on the relevant source data sheet.

5.0 Related documents N/A

6.0 References N/A

7.0 Approval and sign off

Author:

Name: Barbara McLaren

Position: Senior Research Nurse

Signature: _____ Date: _____

Approved by (either Core Manager or CRM):

Name: Gordon Hill

Position: Nurse Manager

Signature: _____ Date: _____

Name:

Position:

Signature: _____ Date: _____

Appendix 18

The standard Operating Procedure (SOP) followed to measure waist and hip of the study participants: Wellcome Trust Clinical Research Facility (WTCRF) document.

Document Number: CRF/2005/N&C/V2/B015

Title: Measurement of waist circumference and waist to hip ratio

Version 3

Author: Dawn Lyle

Effective from:	25 Jan 2006
Valid to:	24 JAN 2009
Superseded Version Number & Date (if applicable)	Version 2

Revision History

Comments: Significant changes to section 4.0

Date: 18 Jul 2006

Next review due:

Signature(s):

Reviewed by:

Date:

Next review due:

Signature(s):

5.0 Purpose

The purpose of this Standard Operating Procedure (SOP) is to ensure accurate, repeatable measurements, whilst maintaining patient safety and dignity.

6.0 Scope

This SOP refers to the measurement and recording of a subject's waist circumference and waist to hip ratio, for studies undertaken within the CRF.

7.0 Responsibilities

It is the responsibility of the CRF nurse performing the measurement to ensure subject comfort and safety throughout the procedure.

8.0 Procedure

- 4.1 Explain the procedure to the patient/subject.
- 4.2 Ask them to remove necessary clothing to enable the measurement to be made directly on the skin surface. Ensure patient/subject dignity is maintained.
- 4.3 Ask them to stand in a comfortable position with their feet about 30 cm (1 foot) apart and parallel to each other. They should stand with their weight equally distributed to both feet and with their arms folded across their thorax.
- 4.4 To determine the waist measurement, locate the lower rib margin on one side of the patient/subject using a gentle upward motion. Mark this location at the mid axillary line using a water-soluble ink pen.
- 4.5 Using the lengths of your fingers locate the bony prominence above the hip (iliac crest) top of the upper hip bone using a gentle downward motion. Mark this location at the mid axillary line.
- 4.6 The measurement is taken at the narrowest point between the lower costal border (10th rib) border and the iliac crest. If there is no obvious narrowing the measurement is taken at the midpoint between these two landmarks.
- 4.7 To ascertain the midpoint measure the distance between the lower costal border and the iliac crest, marking the skin with a water soluble ink pen. If preferred this may also be done if the narrowest point is obvious.
- 4.8 Standing behind the patient/subject wrap the measuring tape around them, place the measuring tape over the middle marks at the mid axillary line. The measuring tape should be horizontal and not be too tight or too loose.
- 4.9 Ask the patient/subject to lower their arms to a relaxed position and breathe in and out normally. As they breathe out take the waist measurement. Record this measurement on the study documentation. To ensure accuracy of the measurement repeat step 4.9. Do not remove the tape from around the patients'/subjects waist.
- 4.10 To determine the hip measurement ask the patient/subject to assume a relaxed standing position with their feet together and gluteal muscles relaxed. Arms should be folded across their thorax.
- 4.11 Stand at the side of the subject and pass the tape around the buttocks with the left hand then grasping it with the right hand. Lower or raise the tape until the

maximum circumference is located. This usually correspond to the level of the symphysis pubis. The tape should fit comfortably and not be too tight or too loose. Ensure the tape is kept horizontal

- 4.12 Ask the patient/subject to relax and breathe in and out slowly. As they breathe out take the hip measurement. Record this measurement on the study documentation. To ensure accuracy of the measurement repeat step 4.11. Do not remove the tape from around the patients'/subjects hips.
- 4.13 To determine the waist to hip ratio divide the waist circumference by the hip circumference and record on study documentation.

5.0 Related documents

N/A

6.0References

ISAK Anthropometric Methodologies (International Society for the Advancement of Kinanthropometry) Sara SmithBSc RD level 3 ISAK Anthropometrist.

7.0 Approval and sign off

Author:

Name: Dawn Lyle

Position: Research Nurse

Signature:

Date: 18 Jul 2006

Approved by (either Core Manager or CRM):

Name:

Position: Charge Nurse

Signature:

Date:

Name:

Position: Nurse Manager

Signature:

Date:

Appendix 19

The Standard Operating Procedure (SOP) for application of Omron 705IT monitor to measure blood pressure of the study participants: Wellcome Trust Clinical Research Facility (WTCRF) document.

Document Number: CRF/2006/N&C/V1/B026

Title: Blood Pressure & Heart Rate Measurement using Omron 705IT monitor
Version 2
Author: Lesley Breen

Effective from:	31 Jan 2006
Valid to:	30 Jan 2009
Superseded Version Number & Date (if applicable)	Version 1 30 Jan 2006

Revision History

Comments Converted to new template from SOP B3.10 by Dawn Lyle
10th Jan 2006.

Reviewed by: Sharon Cameron and Geraldine Cummings

Minor changes to 4.5. Addition of 4.31, 4.6

Date: 31 Jan 2006

Next review due: 01 Jul 2006

Signature(s):

Comments

Reviewed by:

Next review due:

Signature(s):

9.0 Purpose

This Standard Operating Procedure (SOP) describes the correct procedure for the operation of the Omron 705IT monitor ensuring that the results are accurate.

10.0 Scope

This SOP applies to the correct operation and maintenance of the Omron 705IT monitor within the Clinical Research Facility (CRF).

11.0 Responsibilities

- 3.1 Use of this equipment is the responsibility of the CRF staff using the Omron 705IT monitor
- 3.2 All staff using this equipment should receive relevant training on its use prior to commencing the study
- 3.3 It is the responsibility of the CRF staff using the Omron 705IT monitor to have read this SOP

4.0 Procedure

4.1 Positioning of subject/patient

- 4.1.1 Explain procedure to patient/subject, and inform them of the minor discomfort that may be felt and the number of recordings required
- 4.1.2 Position the person sitting, lying or standing as per study protocol (sitting or lying makes no difference to blood pressure (BP) readings provided the arm is in correct position as below)
- 4.1.3 3 minutes lying or sitting, or one minute standing is recommended prior to initiating a recording
- 4.1.4 The subject should be in a warm environment. Tight or restrictive clothing should be removed from the forearm
- 4.1.4 Position and support the patient's arm horizontally on a level with the mid-sternum

4.2 Application of the cuff

- 4.2.1 Only cuffs approved by OMRON must be used with this monitor
- 4.2.2 The standard sized cuff is designed for an arm circumference of 22-32 cm. (An extra large cuff for arm circumference of 32cm-42cm is also available)
- 4.2.3 The cuff may be fitted over thin clothing but, please ensure that the clothing does not constrict blood flow
- 4.2.4 Fit the cuff around the patients arm so the green mark is located over the brachial artery and 2-3 cm above the antecubital fossa. The tube should run down the centre of the arm.

4.3 Preparation of the monitor

- 4.3.1 **Check the date and time recorded on the monitor is accurate. If not adjust using the 'SET' and 'ADJUST' keys on the top right of the monitor.**
- 4.3.2 Connect the air tube to the air inlet port (on the left side of the device)
- 4.3.3 Press the on/off button (O/I); all the symbols on the display will light up. All the symbols go out and the deflate symbol starts to flash (▼).

4.3.4 When the preparations for measurement are complete, the 'ready to measure' symbol (♥) appears on the display

4.4 Measurement

4.4.1 Press start button. As the cuff inflates the monitor will automatically determine the ideal inflation level.

4.4.2 The air will then automatically be released and the reading on the display drops. As soon as the patients pulse has been detected the (♥) symbol begins to flash and, at the same time the monitor bleeps

4.4.3 When measurement has finished, the systolic and diastolic blood pressures and heart rate are displayed on the screen

4.4.4 The pressure drop symbol (▼) indicates that the remainder of the air in the cuff is deflating. When all air has escaped the (♥) symbol appears on the display and the BP and pulse are displayed. The results are now transcribed into the study source data, stored in memory or printed as per study protocol

4.4.5 Press the (O/I) to turn the monitor off. The monitor will automatically turn itself off after 5 minutes if not turned off.

4.5 Storing the measurements

4.5.1 The monitor can store 28 sets of readings in the memory. Each time a measurement is complete it will automatically be stored in the memory

4.5.2. To recall a measurement, turn the monitor on by pressing (O/I).

4.5.2 Press the (M) button to recall the stored readings.

4.5.3 To delete all the stored readings press the (M) and (O/I) button simultaneously (Note: you can not partially delete stored readings).

4.6 Printing the measurements

4.5.4 Attach the Omron printer using the attached USB cable to the USB port on the right hand side of the device.

4.5.5 Press 'DATA/STOP' to print the most recent measurement

4.5.6 Press 'ALL DATA' to print out all stored readings and the mean of those readings

4.5.7 The month and date are displayed in the top left corner of the print out. The time is displayed in the top right corner.

4.5.8 The printout should be signed and dated by the CRF nurse or investigator. Attach printout to study documentation as per flowsheet/ protocol.

4.5.9 Measurement print outs must be photocopied and stored/archived as source data as the printout is not suitable for long term storage (>1 year), as it will degrade over time.

4.7 Maintenance and Servicing

4.7.1 Only use a soft slightly moist cloth for cleaning the monitor. Stains on the cuff can be carefully removed by using a soapy cloth. It should not be washed or immersed in water.

- 4.7.2 Annual maintenance of the monitor should be undertaken by the Medical Physics Department to ensure it is functioning correctly and accurately.
- 4.7.3 Refer to instruction manual for further information if required. The Omron 705IT has been validated by the British Hypertension Society according to their protocol

5.0 Related documents

N/A

6.0 References

- 6.1 Omron 705IT instruction manual
6.2 Omron printer instruction manual
6.3 British Hypertension Society website www.bhsoc.org

7.0 Approval and sign off

Author:

Name: Lesley Breen

Position: Senior Research Nurse

Signature:

Date: 27 Jan 2006

Approved by (either Core Manager or CRM):

Name: Sharon Cameron

Position: Nurse Manager

Signature:

Date: 31 Jan 2006

Name: Geraldine Cummings

Position: Charge Nurse

Signature:

Date: 31 Jan 2006

Appendix 20

Participants' information sheet and consent forms in the pilot study of the prevalence of cardiovascular disease risk factors among Iranians living in Edinburgh.



A pilot study of the prevalence of cardiovascular disease risk factors among Iranians living in Edinburgh

Study participants' information sheet and consent form

You are being invited to take part in this research study. Before you decide it is important for you to understand why the research is being done and what it will involve? Please take time to read the following information carefully and ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

1. What is the purpose of this study?

Cardiovascular disease (disease of heart and its nourishing arteries) is a major cause of death and illness throughout the world. Unhealthy diet, physical inactivity and tobacco smoke are known to be serious risk factors for narrowing and blockage of blood vessels which nourish heart.

There are few studies investigating the prevalence of cardiovascular disease and its risk factors in Iran and despite increasing migration from Iran to other countries fewer still among Iranians living abroad.

Results of this research will be used to plan a bigger study which will lead to identify Iranian profile of CVD risk factors and consequently to control the disease amongst Iranians living in the UK and similar European countries. This will also be influential in planning appropriately tailored preventive programmes within NHS

(National Health System) to the needs of Iranians. Successful implementation of this study will lead to PhD degree for the study main researcher.

2. Who could participate in this study?

All Iranians aged 18 and over who permanently reside in the UK may participate in this study.

3. Do I have to take part in this study?

It is up to you to decide whether or not to take part. If you decide to participate, you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason. A decision to withdraw at any time, or a decision not to take part, will not affect the standard of health care you will receive in the future.

4. What will happen to me if I participate in the study?

To participate in this study you may call the study main researcher for an appointment. Consequently, you will be invited to come to the Wellcome Trust Clinical Research Facility Centre (WTCRFC) in the Edinburgh Western General Hospital (WGH) for which compensation to cover travel expenses will be available. You will be asked a number of questions in relation to your risks of cardiovascular disease and your blood sample will be taken for analysis of your blood lipids (fats) and glucose although you could refrain from giving blood. All of this interview and sample taking will be done within 90 minutes. You will be requested to fast for at least 10 hours for taking accurate blood sample (This will not requested if you already have diabetes). Participation in this study will not affect your other daily routines such as activities or medications. Results of your CVD risk analysis will be sent to you or your GP if you permit. All questions will be asked from you in this study are related to risks of CVD but, nonetheless, you will have the choice to decide whether or not to answer a question or number of questions.

5. What will happen to my blood sample if I take part in the study?

A part of your blood sample will be used for analysis of the blood lipids (fats) and glucose and if you permit remaining will be stored in a freezer at the University of Edinburgh for future research on CVD by only a member of the current research team. The samples will not be used for DNA purposes.

6. What are the side effects or disadvantages for those who participate in the study?

There are no known side effects or disadvantages for the study participant, aside from slight pain during blood sample taking.

7. What are the possible benefits of taking part?

Through participation in this study, you will receive results of your blood sample analysis for glucose and lipids and be aware of your cardiovascular disease risks. We hope this information will help you to adopt a healthier lifestyle. The information we will get from this study may help us to understand the pattern of cardiovascular diseases risk factors among Iranians living in the UK and to plan a large-scale study in the future. This could lead to more effective plan of preventive measures and to attract attentions to the health issues of Iranian ethnic group. This study will be a part of my research activity leading to PhD degree.

8. What if something goes wrong?

To the best of our knowledge there is no harm to you in taking part in this study so there are no special compensation arrangements. If you wish to complain or have any concerns the normal National Health Service complaints mechanisms will be available to you. The University of Edinburgh is responsible for compensation of injuries that results from procedures carried out in accordance with the protocol for this study. The University of Edinburgh will not compensate you where such injury results from any procedure carried out which is not in accordance with the protocol of the study. Your right at law to claim compensation for injury where you can prove negligence is not affected.

9. Will my taking part in this study be kept confidential?

All information that is collected about you during the course of the research will be kept strictly confidential. Any information about your health will have your name and address removed so that you cannot be recognized from it. Your information will be inspected by the researcher and by the responsible supervisors for analysing the results. Your name however, will not be disclosed outside the hospital (WGH). Your GP will be notified of your participation in this study and a copy of the results from analysis of your cardiovascular risk status will be send to your GP. **If you don't want your GP to be informed** about your participation in this study or your cardiovascular risks please tick appropriate box in the consent form.

10. What will happen to the results of the research study?

This study will be published in the PhD thesis of main researcher. The results may be published in medical journals and an abstracted copy of the study results will be sent to study participants on request. But you will not be identified in any report or publication.

11. Who is organising and funding the research?

This study is funded partly by the Iranian Ministry of Health and Medical education (MOHME) and other expenses possibly will be funded by another funding organisation within the UK. (At any circumstances, no personal data will be passed on to organisation outside the university). The study is organised within the University of Edinburgh and is under full supervision of highly qualified researchers in the university (Professor Raj S. Bhopal, Professor Aziz Sheikh, and Dr Farshid Namdaran). The study researcher will not be paid for including you in this study.

12. Who has reviewed the study?

The NHS Research Ethics Committee had reviewed this study proposal and approved it.

12. Contact for further information:

A.Reza Shaghaghi
Public Health Sciences
Department of Community Health Sciences
The University of Edinburgh
Medical School, Teviot Place
Edinburgh, UK
EH8 9AG
Tel: xxx xxxxxxxx
E.mail: reza.shaghaghi@ed.ac.uk

Thank you for your participation and cooperation in this study.

You will be given a copy of this information sheet and signed consent form to keep.



Consent Form (1)

Title of Study: *A pilot study of the prevalence of established cardiovascular disease risk factors among Iranians living in Edinburgh.*

Name of the researcher: Abdolreza Shaghaghi

1. I confirm that I have read and understood the information sheet dated 9th, May, 2006 (version 06-03) for the above study and have had the opportunity to ask questions. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. ☐
3. I agree to take part in the above study. ☐
4. I agree that my GP be informed about my participation in this study. ☐
5. I agree that my GP receive a copy of the summary of my cardiovascular risk status. ☐

Name of participants	Date	Signature

Name of person taking consent (If different from researcher)	Date	Signature

Name of researcher	Date	Signature

A.Reza Shaghaghi

1 for participant; 1 for researcher; 1 to be kept with individual files in the research organisation



Consent Form (2)

(Consent for possible future research)

Research on the future cardiovascular risk factors such as level of C-reactive, urea and creatinine, homocysteine and its essential metabolic cofactors such as cobalamin (vitamin B₁₂), folate, and vitamin B₆ ...)

Title of the main Study: *A pilot study of the prevalence of established cardiovascular disease risk factors among Iranians living in Edinburgh.*

Name of the researcher: Abdolreza Shaghaghi

1. I confirm that I have read and understood the information sheet dated 9th, May, 2006 (version 06-03) for the above study and have had the opportunity to ask questions. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. ☐
3. I agree to allow my blood samples to be stored for use within future other cardiovascular risk factor studies (samples will only be used by a member of the current research team but not for DNA purposes). (This will require getting new permission from the Ethics Committee). ☐

Name of participants	Date	Signature
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Name of person taking consent (If different from researcher)	Date	Signature
<hr/>		
Name of researcher	Date	Signature

A.Reza Shaghaghi

1 for participant; 1 for researcher; 1 to be kept with individual files in the research organisation